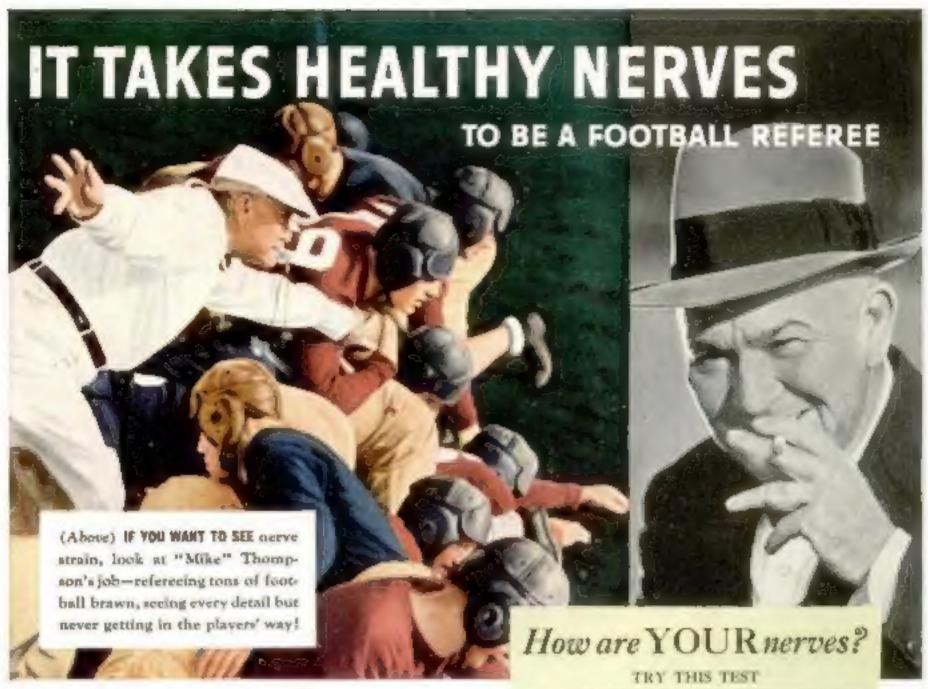


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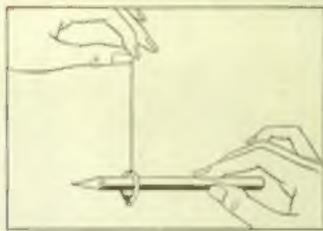
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George Sentelly (Comel smoker), shampron fencer, did it up the first tra-

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In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions



THERE are many fine things in life that we take almost for granted. Health, water, sunlight, green fields, loyal friends, a home to live in. . . . Not until some mischance deprives us of these priceless possessions do we learn to esteem them at their true value.

It is in much the same manner that most people regard the telephone. Millions of men and women have never known what it is to be without one. Each day, each week, each year, they use it freely, casually, as a matter of course.

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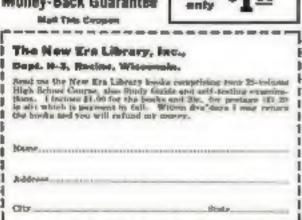
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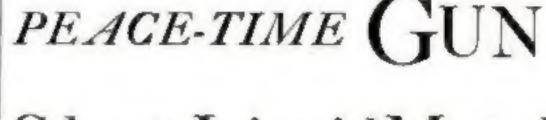
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This tool came from Europe with many defects. American engineers, after spending many years of research along the same lines, saw its possibilities and set to work perfecting the tool. Although it is still short of perfection, the fact remains that its practical value has already been well demonstrated. On one project alone—the great span of the George Washington Bridge over the Hudson River, it is estimated that this metal spray gun saved hundreds of thousands of dollars. Now, these same engineers say, it is destined to revolutionize a thousand different industrial processes.

Several years ago the pages of this magazine carried the first reports of the perfection of this tool. Immediately letters began pouring in-letters from every conceivable type of business in the country. Would it do this, would it do that? How much did it cost, where could it be bought?

To many people this revolutionary invention will not seem important. But some men will stay up nights figuring out a way to make use of it. They are men who are constantly on the look-out for new things and new ways of doing things that can be applied to their own business.

Just as thousands of correspondents are constantly sending us news reports on science and industry from every corner of the globe, so are other thousands searching the columns of this magazine every month for news of any and every useful development that they themselves can use profitably.

For it is here that men alert to the need of keeping abreast of new developments in science and industry meet on a common ground. It is here that they have the news monthly of Progress-where they can have faith in the timeliness and authority of the FIRST reports of science's new ways to help them keep ahead of the parade.

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tready flow of premium and interest income, both in good times and bad, making it unnecessary to merifice investments to obtain cash.

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the almost incredible thing of investing for the benefit of policyholders two billions of dollars in new securities during those days of money scarceness?

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Our Readers Maybe We'll Stay Indoors When We're All Air-Conditioned

That item in your November issue about the air-conditioned automobile interested me particularly. With sir-conditioned homes, theaters, office buildings, department stores, and now automobiles, it looks as though the

average individual soon will be living in an entirely artificial atmos-phere. What effect is all this incubator living going to bave on our general resistance to hot and cold? Unless they air-condition the streets, we still will have to walk the short distance from the office to our car. After many



hours of pure air at just the right temperature, won't the sudden change on hot summer days and key winter nights be a little too much for us?-L. D. S., Chicago, Ill.

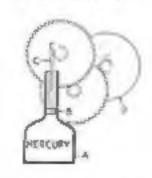
That Old Guroscope Is Now Asked to Tell the Longitude

AFTER reading the article by W. W. A. of New York on reading latitude with a gryoscope I am wondering why he stopped with reading latitude. If it will work with latitude, it will work with longitude. W. W. A. says, "When a gyroscope is set in motion and its axis pointed toward some stationary point in space 2 tends to remain pointed toward that spot regardless of the rotation of the earth or the gyroscope's position on the earth." If that he true, then why not point the axis toward the sun, at which it would continue to point day and night if the gyroscope has a universal mounting. Then by establishing the senith above the ship with a plumb, one could slways tell the relating of the sun to the established senith. Then by checking the number of degrees between sun's senith and plumb-line arnith, one could know his longitude.- J. W., Jr., WADE, N. C.

This Mercury Problem Will Give You Some Trying Moments

Haze is a problem upon which I should like the opinion of your readers: A stee! bottle (A), with a capacity of about ten-cubic inches, is filled with mercury up to the plunger (H). Hy raising the temperature to 100 degrees F, the mercury will expand and push upward the rack (C) which is so connected by gearing that it will wind up spring (D) which in turn is connected to

the ordinary mechanism of a clock. Now the question is: How much energy in pounds could I obtain from 1,000 cubic inches of mercury expanding in the oneinch neck of the bottle with a temperature of 100 degrees F.? It is possible that I may be able to put



this device to practical use if someone gives me a little belp .- C. B., Freehold, N. J.

Gunboat Once Propelled by Water Forced from the Steen

Your recent article about a propellerless motorboat, driven by jets of water pumped astern, recalls the many interesting attempts that have been made to apply jet propulsion in a practical way. Few remem-ber today that the British Admiralty acrually fitted a 162-foot gunbout, the Waterwitch, to be propelled solely by pumping water in at the bow and forcing it out at the stern. The strange craft performed satisfactorily in tests, and her method of locomotion was considered a considerable ad-vance. This was in 1865, when puddlewheel ships still were the rule. The experiment was short-fived because of the advent. of the screw propeller. But there are many today who believe jet propulsion will be applied successfully to vehicles of the future. and of course all rocket-drives machines would fall within this class.-C. G. S., Baton Rouge, La.

He Had His Moon and A Nice Rainbow, Too

Unean the caption "Why a Rainbow? Isn't a Nice Moon Enough?," L. M. G., Lewiston, Pa., asks if anyone has over seen a rainbow during a shower on a encoult night. I have seen one. The occasion was a summer

night about eight or nine years ago. My bome faces the northwest. I stepped out into the yard, and noticed that a dark cloud was approsching from the west, and that in the cloud there was a faint, yet distinct, are like a rainbow. I looked at it closely wondering what it could be, and



then turned around to the east and saw that the full moon was about an hour high. There was no other explanation but that it was a minhow by moonlight, I called my family and we watched it for probably ten minutes. The colors were barely dis-cernible, but the bow or are was perfect, and the whole effect very weird. So our family had the good fortune to enjoy a perfectly nice monn, and a faint ghost of a rainbow -C B K Bristol, Va.

This Alert Reader Finds Curvature Problem Too Easy

E. E. S., of Lamar, Neb., has had his sleep disturbed unnecessarily. His problem of earth curvature per mile, as he calls it, can be solved mentally. The perebral gymnastics are: (1) Divide unity by four thousand and then by two mentally; result-0.000125 which represents the desired curvature in miles. Convert to inches in two steps. (2) Multiply 0.000123 by 5280. This is easiest done by pointing off three places and dividing the resulting 5.280 by 5. Result 0.66. (3) Multiply 0.56 mentally by 17. This is easiest done by adding 7.2 to 0.72, Result 7.92, The

last figure is the curvature per mile of tangent on the earth's surface stated in inches, Strictly, it is the offset from a tangent to a chord, the tangent being one mile long.— C. R. S., Greensboro, N. C.

Our Actist Says He's Covered with Confusion

I apprentiate the good articles you have had lately an photography. Keep it up. I remember a number of years ago, before radio and television, yes, and even autos,

were to vogue, that a large part of your magazine was devoted to photography. Now it looks as though it were coming back. The lure of the aventest hobby, photography, has certainly held its own, even through the depression. Twenty years ago, it was my bobby. It is yet, and



also my business, and I want to say that the articles you have published certainly have been helpful. What's that: On page 80 of your November issue, the bottom part of the human being looks ladylike, and the top part looks something like a good looking young man. We don't see that kind out here in a real country. And your "man" is nearing a lady's apron with pronmental pockets 'n everything! That ought to be a good one for your next series of "What's wrong with this picture?" Anyway, "it" doesn't belong out here in Montana.—L. H. J.—Helena, Mont.

Model for Tiny Gasoline Engine Is Requested

I stroots like to see articles in your magasine describing the building of a miniature railway locomotive. One that can be built without the use of a lathe. Also articles on how to build a three-inch gasoline engine that will really work, Articles on electrical experiments are very interesting, as are also articles on photography, chemistry, and au-tomobiles.--W. L. Chicago, 10,

Reflecting on This Teaser Might Lead to an Answer

Arrea looking through every book, magazine, and periodical is every library in Los Angeles, I am writing an appeal to all you Einsteins that read Portlan Science

Mastring, Ready? Let's go. Of course, you all know that the closer you get to the sun the botter it becomes and you also know that because the moon has no atmosphere the temperature on the moon is very high. So that proves that the less atmosphere and the closer a body



CHARLES HARRY

gets to the sun the hotter it becomes. Now

why is it that the further you get away from the earth's surface in the direction of the sun, the colder and colder it becomes? Will somebody explain this to me white there is still a chance to save a bursting head?—M K., Los Angeles, Calif.

That Overworked Magnet Gets One Final Jolt

A raw months ago G. C. asked what maintains the energy in a permanent magnet. In a recent issue of Popular Science Monthly, F. B. K. answers this question in a way that is not satisfactory to me. Now let us explore the phenomena of permanent

nent magnets more fully. In the first place, it is the magnetic field of the magnetic field of the panets around it, instead of the field of gravitation, as New ton thought. For if such were the cause, the planets would follow the sun in a fashion of gene following their leader Now, when



we make a permanent magnet by the use of an electromagnet, it means that we disjust free electrons from a piece of iron, thus permitting the magnetic waves of the sin and the earth to pass treely through said piece of iron. There's we have made a permanent magnet Such a permanent magnet upon the planet Mercury would be three times as strong as on earth, while apon the panet Pluto its power would be very small For a similar reason, a permanent magnet produces more energy than in put into it as it is not excised that a waterfull will produce more energy than it took to open the sluice. The reason why other elements are not adaptable to serve as permanent magnets is because notiber their protons nor electrons remain in a paramet plain when under the influence of magnetic waves.—
F. A. R., Cleveland, Ohio.

A Nose Dive in a Plane Would Settle This Problem

I wave a question which mucht be of interest to some of your readers. In school I learned that the difference between a garand a inquid is that a gas fills the container it is in while a liquid keeps the same volume for all containers under equal cond tions, and takes the shape of the contaurer. A thought came to me that perhaps the force of gravity made liquids have a definite volume or level. What would happen if gravity could be neutralized? Would a figuid under such conditions fill its container like gos? A test could be made in a fast elevator or a diving airplane. At the point where acceleration and gravity balance, what would happen to some water in a bottle?

I wonder it some of your readers could newer my question.—B. S., Sea Cliff, N. Y.

Amateur Science Club Is In Tune with the Times

You and your readers may be interested

to know that we have just organized an Amateur Science Chib in this neighborhood. The purpose of the Club is to aid its members to scientific research an experiment. At one experiments At one ent we are exclusively studying rock crystals and formations. We are regular readers of Poput Lar Science Monthly



Ly and feel that other communities might be interested in forming class similar to ours.—Yano Science Cane, Salem, Mass

That High-Altitude Steam Engine Still Leaves Him Cold

H. OF New York, backs up a recent claim that a steam-driven plane gasm in eforsency the bushes it goes by he in is to present convincing evidence. He says "The exhaust in the new plane's engine leaves directly from the boder " from which I infor that he means the exhaust leaves directly from the engine and is discharged through the outlet of the combustion chamber to increase the draft through the burner similar to the system used in a locometive This is a common pract of But who should anyone claim that this system would be more efficient five miles up, where a good portion of the heat generated is needed to raise the sub-zero temperature of the air before it can generale steam, than it is at sea level where the air is comparatively warm and about twice as much oxygen available for combustion in every cubic foot of use used?— J. N. F., Stores, Conn.

A Nufty Little Method for Truecting the Angle

ONE often bears that the treection of the angle by company and straight edge in tinpossible. This is only partly true, for any angle may be trisected to the billionth part of a degree, if compass and straight edge capable of such precision can be found Evet since the uncient Greeks propounded the problem, students have been attemptone its solution. Many methods have been proposed, but all of them have been either crude approximations or complicated constructions. The following method has the advantage of extreme simplicity and of being accurate. To truect an angle first draw an are across it from ude to side reverse the direction of rotation to the midpoint of the arc, reverse again, going back to the middle of the half. Continue these reversals making each new are ball as great

as the one before. It the radiot is increased with each reversal, the oscillations noon straighten sure a line. The accuracy with which this line trisects the angle depends only upon the number of reversals made, that of the illustration beam correct to the thousand the light of the light o



By repeated bisection, an angle may be divided into two, four, eight, or any power of two equal parts. In this way, if it be divided into 1,048,576 equal parts, the trisection point will be turbilly squeezed between the 349,575th and the 349,575th marks, and will be correct to the millionth part of its arc. It can be shown that this method will never give the exact trisection point, even though carried to infantly. It therefore does not theoretically solve the Greek pupblent.—

T. A. C., Campbell, Calif.

Just a Farewell Shot at the "Brains of Biologists"

I as an a seed a the small dogma of C. C. J., Nanticoke, Pa. I also note the following statement made by J. H. P., London, England. "There is, in any modern book on biology, proof of even more ancient ancestry, namely, evidence in the human embryo of fish descent." There is a similarity in some of our adult humans to the fish, the sucker types, who are willing to swallow any lare cast upon the waters. For twenty years I have tried to analyse the term "proof" as applied by some scientists and in this connection wish to ask J. M. P. to study, without prejudice, the mattery of life and of human superiority biany terms in the language of science cover

much ignorance. They are sometimes used dozmatically in attempting to reach a "proof." We are willing to accept facts which are facts, but "facts" that require a philosophy for their substance are only theories. There are quantities, there are quantities. Our science of quantities lags behind the science of quantities. Brains of biologists are fogged. We must be careful with our "proof." We are not without a definition but for an understanding we meditate on the use of such terms as cromosomes, protoplasm, sperm, life, and imbecility.—C. A. S., Cost Ila, N. M.

Now Is There Anything Really New Under the Sun?

When I arrived at page 21 of your November issue, I looked to see if the year-date was 1933 or 1733! The reason was those disk-shaped paddles you say a New

Yorker has invented for swimmers to strap to their hands for increasing their speed. More than 200 carago, when he was in London as a young man, her jaman Frank his startled Englishmen by swimming flown the River Thames aided by exactly the jame kind of hand-paddlet. I saw



a drawing of it only a few days ago. Imagine Post 1 to 18 18 18 M \$15 12 18 centures believe the mass. As a matter of fact, I have been saving a frendly little game with you for a long time, trying to catch you printing an old one. This is the first one so for and I want to make the most of it!—E. R., San brancisco, Calif

One Last Word to Solve the Mysteries of Light

I RETURLY disagree with J K G. and his ted hot needles in a beam of light. If this were the case, we could see the beam at an angle in space as well as in direct line. Thu, however, is not the case. A though the earth shuts off a very small portion of the sub's rays, it apparently ceases to shore at might laght is merely energy traveling through space at the rate of 186,000 miles per second. When suddenly balted by material substance it is reflected in the form of light. When gradually baked, it both reflects and penetrates (as in water) and the degree of transparency is measured by the suddenness of the halt. We see the beam of a search light from an angle because the atmosphere is flects it The denser the atmosphere the greater the reflection, as in cleads. It takes energy to reflect a light beam and this energy is converted into heat, hence, the reflecting body gains heat during the period of its reflection -M R Q., Los Angeles, Calif

First in Our Pages and Then All the World Has Them

I LIKE POPULAR SCIENCE MONTHLY because it is always full of sound, practical ideas I have the issues almost complete back to

and including 1925 It is interesting to did out the old numbers once in a while and see the great purcher of ideas advocated in them that have since become well-known commercial products. Radio is my hobby so naturally I want lots of radio. How about a five-tube "Super Het" using the



new two-volt battery tubes? Give the country radio bug a treat and see how we like it M B B, Portersville, Olio.



and thousands of other subjects...

Address



POPULAR SCIENCE

MDNTHLY

January 1934

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RAYMOND J. BROWN, Editor



HOW UNCLE SAM'S MICROSCOPES FIGHT



NA door in one of the United States Department of Agriculture buildings in Washington are the words "Micronialytical Laboratory," The door opensists a room where the business of an swering the question "What is in it' amounts to a highly-developed science. It is here that B. J. Howard, micronicopist in charge, and George L. Keen an, micronialyst, together with their assistants, turn their powerful lenses upon hair dyes, mits, peas, patent medicines, tomatoes, beauty preparations, and the thousands of other things that the Food and Drug Administration investigates.

One day an inspector at a southern port sent to Washington a sample of coffee which he suspected of not being pure. It was in the roasted, ground form commonly employed in hitchens. To the microanalytical laboratory went the sample, At moderate magnifications, the microscope revealed that, in addition to the irregular pieces of coffee beans, there were little, relatively uniform peliets about the same color as the coffee, "What's in the pelicis?" was the question now before the experts in the laboratory

Some of the particles were separated carefully from the legitimate coffee and were maistened and crushed into a paste. Using a higher magnification the interescope experts discovered that the particles were made of coffee chaff mixed with type cereal. The approxi-

mate quantity was determined. As the ryechoff peliets formed an adulterant, the Government, backed by the indisputable evidence of the microscope, could



By Walter E. Burton

take action against the person or company who had tried to cheat coffee drinkers by selling interior stuff

At another time George P. Larrick,

chief inspector, brought Howard and keenan a bottle containing a dark-colored liquid. It was supposed to cure diabetes if the sufferer could afford to pay \$12 a pint for it. Government inspectors were convinced that it was a fake, but they had to know just what kind of a fake. So Larrack asked "What's in a " And proceeded to find out

Under one of the microscopes went a drop of the medicine. The analyst could see nothing that would give him a positivé answer, So he placed some of the bound in a centrifuge and whirled it several thousand times a minute. When he stopped the machine, he found, in the bottom of the contamers, solid material that had been driven by centrifuga. force out of auspension in the water. He ameared some of this sludge on a slide and slipped it under the microscope. A glance at the particles he now could see revealed that they were minute pieces of plant tissue But what plant?

Answering that question was a matter of comparison. An essential part of the laboratory is a many-drawered cabinet holding scores of bottles containing samples.

of substances likely to be encountered foods and drugs. The microscopus simply compared the diabetes-medicine through with samples from his well stocked cabinet until he succeeded in matching them.

In the end it was found that the "cure" consisted essentially of nothing more than water containing extract of equisetium—commonly known as "horse tail" plant. Of course, this concoction, made by boiling the plant in water, was of no use in treating diabetes. Backed with this knowledge facts that the microscope had made available, the Food and Drug Administration could proceed with a campaign against the so-called medicine

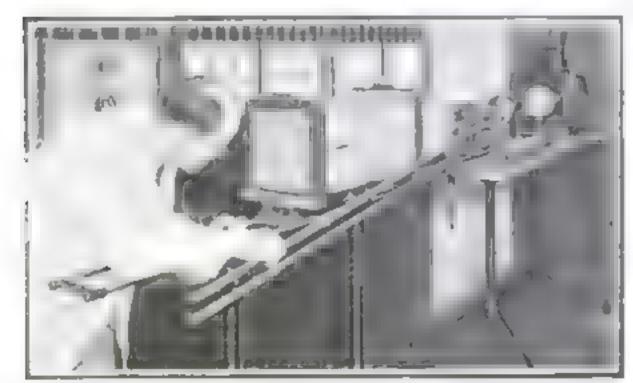
The microanalytical laboratory affords many examples of how the microscope, an instrument which is revealing new wonders to thousands of amateurs, can reach its highest degree of usefulness. A varied collection of microscopes, each necessarily more refined and complicated than the average amateur instrument, keep their watchful eyes on the nation's health. They do this by revealing secrets



Here is one corpor of a Government laboratory shows a some of the apparatus used in the of fort to prevent food and drog adulteration



When relarged 150 times, the crystals in spirits appear at above in picture above



George L. Keenen, of the Food and Drug Administration, using a photomicrographic country

about the foods and drugs offered for sale to the pubbe by the manufacturers.

The present food and drug act, which is so inadequate for present-day needs that it is expected to be replaced soon by a new one was put into effect in 1906. The Food and drug Administration was created to enforce it, and the microanalytical aboratory soon became a court of last resort in the matter of answering scientific questions. Some years ago much of the routine work was transferred to held stations of the Admiristration, located in various cries of the Linted States including those which are important scaports.

beventy-right inspectors keep watch over food and drugs that are shipped into this country from abroad over patent medicines of-

tered for sale over earmeries where food in prepared—in fact, over al. food, drugs, and other articles that come within the interest of the Administration. Samples are analyzed by highly trained men at the field stations.

Occasionally these stations encounter difficulties in their analyses, so the specimen in question is sent to Washington and turned over to experts in the well-equipped laboratories. Perhaps the answer can be found by the chemist the



Brucing, a poisonous alkaloid, trested with rine chloride abows crystals like these

pulson expert, or other scientist. Sometimes the only way to find an answer in by intensive use of the microscope.

The microanalyst, according to keenan, must be a kind of super-scientist. He must know a great deal about chemistry, physics, biology, sociogy and, of course microscope technique.

"He must have also a photographic mind" Keenan added. "He has to study and learn to recognize bundreds of drugs, plant tissues, insects and insect parts, flower pollen, mouds, chemical compounds, and crystals. It is by comparing an unknown substance with a known materia.—which may be in a bottle on the desk or in the analyst's mind—that he is able to identify the substance."

· INVISIBLE CAUSES OF DISEASE AND DEATH FOUND



THIS article describes for you the manner in which scientists use the latest aids to research in their efforts to discover and ban from the market adulterated products government inspectors find

In this cabinet, left, this government been mindard samples of drugs that a clinify to be accountered to adulterated foods. Comparison with these samples den fina the ingredient found by the microscope

But being able to recognize a particular aring or a food mold is not enough. The analyst must be absolutely certain that he is right. The Government, in prosecuting offenders of the food and drug law, often bases its entire case upon information revealed by the microscope; and more than unre a microscope; and more than unre a microscope; and to take his ris rumen into court and show the judge and jury what it was all about

Debrate manipulations under the microscope sometimes are the unly means of answering questions that may involve the safety of scores of persons. A dramatic fruit-cake possess mystery affords an example

There was a woman who made and sold fruit cakes that were popular during the holiday season. She disposed of all the cakes in a certain batch, with the exception of one, to local customers. The exception was obtained by a woman who traded a bottle of vanilla for it

Some time after the last cake of the lot had been disposed of, one of the cusformers, not waiting for the arrival of Chrisimus, ate some of the confection and became ill Food and Drug authorities heard about it, and concluded after a hasty investigation that the cakes contained poison, They did not know what poison, and therefore could not trace it immediately to its source and prevent further distribution. While the laboratories were working feverishly on the problem, food and drug inspectors were rounding up all of the posson cakes. They found them-with the exception of the one obtained by the vanisa seller

The maker of the cake recalled that the woman was going to send the cake to a relative in Canada. But no one knew the woman's name, nor the name of the company for which she worked. However, by checking through a newspaper wanted department, her bome address was found. Then it was discovered that she had left for parts unknown, for the bolidays, Eventually her brother was found

Above grains of poteto starch enlarged 125 times viewed under old-nary I ghi Upper right, the same grains, similarly enlarged but viewed under polarised light microscope which brings out details



Photomicrograph, enterged about 200 times, of mold fils mente that are found in rotted load and which cause a ck-

Covernment inspectors are constantly on the steet to accure sumples of lood and drugs, as shown at the left, be ore they eare the warehouse for shiptiest

and from him was obtained the name of the Canadian relative to whom the cake had been sent. Canadian authorities were notified.

Meanwhile the microscope mysterysolvers were at work. Chemists had been
unable to find enough of the poison to
identify So the inscriscope experts, after
trying other tests, placed a small quantity of material from the cake on a microscope slide, added reagents that are used
in testing for known poisons, and examined the precipitates formed by the
chemical action. The poison was recognized in this way as an arsenic self

Another intensive search was launched, this time the quest being for the source of the poson. After arduous investigation, a sack that had contained poisonous insect-spray ingredients was found in an ash can. It formerly had occupied a shelf in a room where a barrel of flour, used later in making the cakes, was stored. No one knows exactly how the puison got into the flour

Canadian officials finally found the cake that the vanilia woman had sent for a Christmas present, seized it, and shipped it to Washington, where it arrived on Christmas eve. It was found to be the worst cake of all—to contain enough posson to hill several people.

The old gag about cigars resembling ropes has a (Continued on page 92)

BY EXPERTS WHO GUARD THE PUBLIC HEALTH



Study Cyclones in



The mouth of the case on top of Mt. Minotecama Chile in which are spectruments to record the varie on of the sun a radiation. Visible in the picture is the consister which reflects sunbeams and the case

By Robert E. Martin

ARMOR plate of invisible gas surrounds the earth and protects us against death rays from the sun'. That sensational discovery has just been announced by Dr. Charles G. Abbot. Secretary of the box boxino Institution, at Washington, D. C. Forty miles above the surface of the earth. Dr. Albot found, a wall of ozone absorbs the short ultraviolet rays which would blind and kill if they reached the ground. The beneficial long ultra-violet rays pass through we hout difficulty.

Although the ozone is diffused throughout the upper reaches of the stratosphere, the total amount is so small it could be compressed into a layer so more that an eight of an inch in thickness, This layer, less than buil as thick as an ordinary lead pencil, is all that stands between life and death on our planet.

While Dr Abbot was making this cramatic appropriement as concurrery at Harvard College observatory and the Massachusetts Institute of Technology came to the end of a sixty-year trail of investigation. They have just solved the mystery of the sun's corona

The source of this streaming, 10,000,000-mile halo, visible around the sun our-ing a total eclipse, has been a riddle ever since it was first observed some sixty years ago. Many have thought it produced by a chemical element unknown to earth. The Cambridge scientists have now discovered it is a product of oxygen in the outer layers of the sun

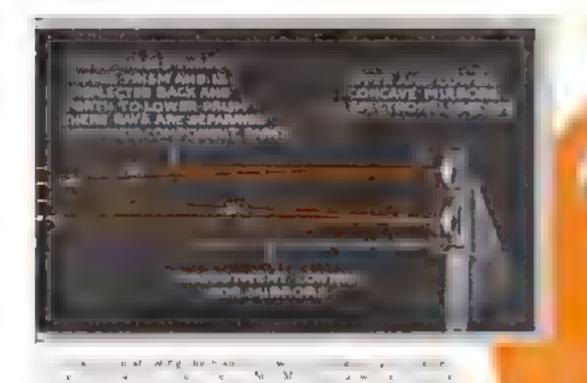
At the same time, Mount Wilson observers, in California, report the smallest number of sunspots in a decade. The end of the eleven-year cycle has been reached and these atomic cyclones on the sun, closely linked to our health, weather and crops, are at their minimum. During the next five years, they will steadily increase

an number until they reach their maximum.

All over the world, American scientists are busy watching the sky and seeking the answers to a host of solar mysteries. Perched on a cone of rock rising \$,600 feet above a north African desert, working in a cave hollowed from the soud granite of the Andes in South America, peering upward from the dat summit of Table Mountain in the Mojave Desert of southern Canfornia, lonely outposts of science are spying on the sun

Already they have established a close connection between flickerings of the aun and changes of weather on earth. Greater knowledge of the laws that link the two is steadily being gained

More than fifty years ago, Samuel Pierpont Langley, later secretary of the Smithsonian Institution, in Washington, D. C., conceived the idea



the SUN

that study of the sun's radiation would point the way toward long range weather forecasting. While in there of the Allegheny Observatory at Pittsburgh, Pa., he began measuring the intensity of the sun's rays. However, he found, this told him little of the actual changes in the sun because the transparency of the atmosphere varies constantly, altering the strength of the rays reaching the earth. What was needed, he saw, was an instrument that would enable him to calculate the variations in intensity of the rays before they reached the disturbing layers of atmosphere surrounding the earth.

As a result, he invented his bolometer, an amazingly accurate electrical heat detector. It will record changes in temperature as small as one ten-militanth of a degree Centigrade. When such instruments are detecting changes in sum heat at several points on the globe at once, the resulting average virtually eliminates the effect of local atmospheric conditions and shows actual fluctuations in the heat given off by the sum.

In 1881 Langley took his botometer and other delicate instruments to Mt. Whitney, in the California Sierras. Here, he not only discovered new invisible short-wave rays in the solar spectrum but also blazed the trail for later calculations in solar rediation

A quarter of a century later, when he had become secretary of the Smithsoman Institution, he resumed his efforts at measuring the rays of the sun, placing Dr. Charles G. Abbot, present secretary of the Institution, in charge of the tests. Curiously enough, what is now considered to have been an error proved the most valuable discovery that had been made up to that time by the experiments.

In March 1903, Dr. Abbot had noted a fall of ten percent in the sun's radiation. Examination of weather reports showed a nearly simultaneous drop in temperature of over two degrees throughout the North Temperate Zone. In view of later experience, Dr Abbot says this apparent sudden decrease in solar radiation may have been the result of an error in observation. If so, it was a lucky slip, for it strengthened his conviction that the sun's radiation varies in strength, that these variations have a profound effect upon the weather, and that study of them can be turned to man a advantage in long-range predictions.

That strong conviction has been the driving force behind the Smithsonian's work during the last thirty years. It has sent scientists (Continued on page 90),





Above. long-range view of the in arradiat on station on Mi. Montesuma It a trongly suggests the molated nature of the post At eft, a clar a chaervatory set up in the field near Bassour Algeria, by Dr. Abbot. The a costroment shown records the energy race wad dayly from sunlight

ONE-DOLLAR SHACK TRANSFORMED INTO A CHARMING COTTAGE

This tharming cottage was remode ed by Washington D. C. architecta at nw cost from an apprent building for which they paid only one do lat-

WEATHER ROBOT FOR ARCTIC

WEATHER reports from bleak Frans Josef Land in the Arctic where Russia maintains a meteorological observatory, are no long r to be transmitted by scientists stationed at this lonely spot. Instead a self-opera tag rate committee, requiring no attendant, will periods, a report directly to national headquarters the readings of me ometic we ther instruments. The robut we ther man infustrated below is the invention of Dr. P. Molchanov. Russian meteorsplogest, and is a counterpart of his automatic radio transmitter.

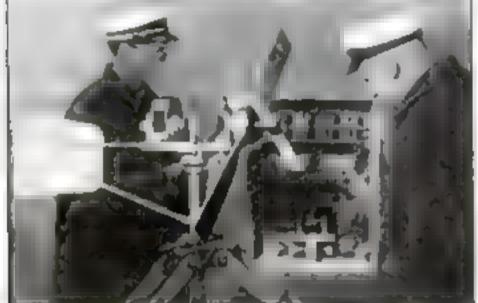
To show what can be done in modernizing a home a worthless shark, bought from the government (or one dollar, has been transformed at low cost into a charming cottage by Washington, D. C., architects and builders. They remult walls, put on an addition, and shortened windows, salvaging and re-using some of the old material. Insulation was applied to walls and roof, modern kitchen and plumbing fixtures were installed, and the transformation was completed by furnishing the house in Colonia. style with inexpensive, rebuilt furniture.



It was this old shack, bought from the Covernment, that was rebuilt my the very attract so home shown at upper sale

HOW TO FLY IS TAUGHT WITH AVIATION TOY

Outgreatty designed for use by students at a thying school, an airplane toy recently placed on the market is declared by flyers to reach children or grown-ups the principles of aviation in a fascinating way. Sitting on the floor, the user manipulates a control stick and rudder bars closely resembling those in a real plane. Thus he moves the rigging the control surfaces.



LATEST MODEL HOUSE HAS NO PARTITIONS

Destance to give its occupants a feeling of airiness and freedom from constraint an ultra-modern style of dwelling named the "space house" by Frederick Kiesler an designer, was recently demonstrated in New York by a non-operating, full-scale model. The interior is almost devoid of walls and partitions, each room inergang into the next. To shut off a living coom or bedchamber from the rest of the house, the occupant presses an electric button, and a hanging curtain on an overhead track is run around the room by a budden motor. Sound-absorbing draperies keep noise in one room from entering another. When doorways are used, the doors do not swing on hinges, made of hanging slats and driven by a motor, they roll up and down after the fash on of a roll-top desk. The exterior of the fourteen-room house has a square shape and flat roof.



At all self operat ing radio transmitter.

which we personned

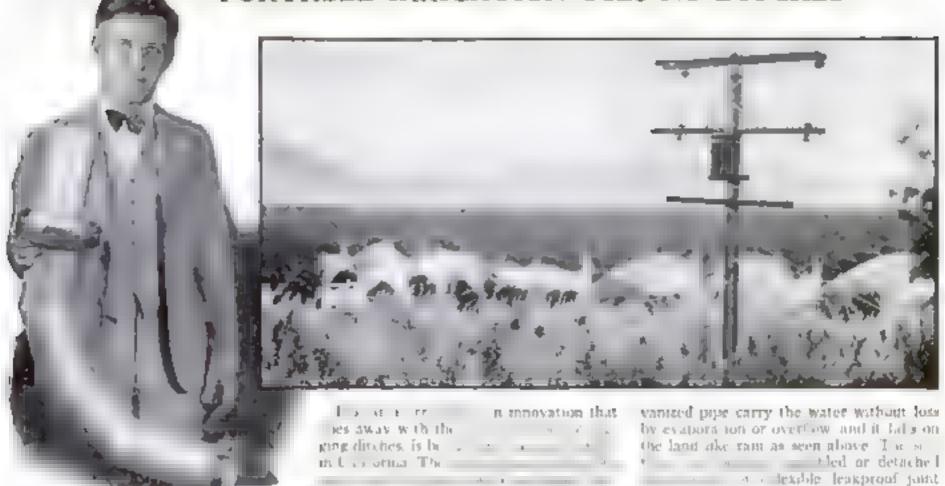
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PORTABLE IRRIGATION USES NO DITCHES

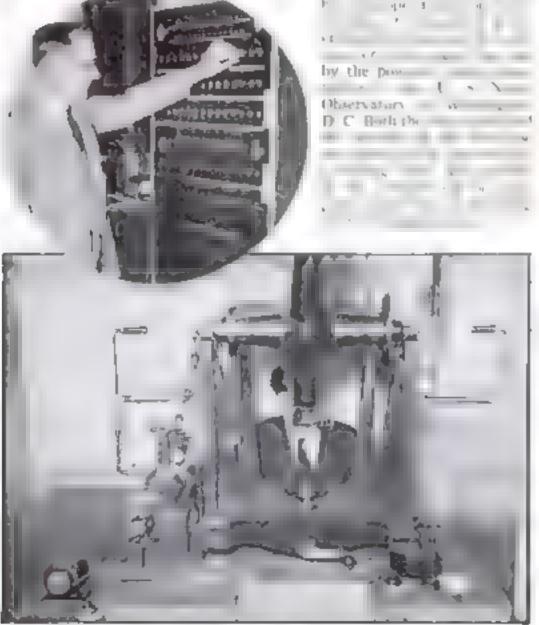


a facres Light

IS NORTH AMERICA MOVING WEST?

Age the Old World and the New World drifting apart? Strong evidence that the continents may be shifting their positions is now being tested. Trained observers all

a night, are simultaneously shooting their exact longitude by triescopic observations. To



In circle, clusting the switch that links meater clock to a radio transmitter and sends signals to observers at telescopes as above, who check their longitude when the signals come in. These records are then compared in an affort to learn if our continent is dulting west

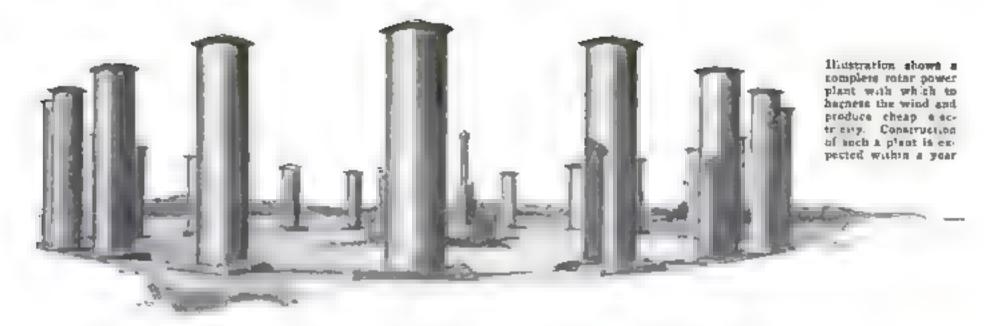


in shown as the let

USE SLOW MOTION PICTURES TO FIND DEFECT IN MACHINE

How slow-motion pictures came to the aid of distressed engineers, when trouble developed in a new machine of apparently sound design, is shown in a case recently reported by a Chicago camera manufacturer. Why envelopes gammed in a high-speed addressing machine, scheduled soon to be placed in the market, was a baffling mystery. The feeding pawl was painted white, and movies were made of the feed mechanism in action, as illustrated above. They showed that the pawl vibrated from time to time, undetected by the eye, and that each time it vibrated it failed to feed an envelope. Knowing the trouble, it was easy for the makers to find the source of vibration. After which the engineers were able, quickly and permanently, to correct the fault.





1070015 PRODUCE ELECTRIC CURRENT FROM WIND

it into power lines. Since it takes only six to eight percent of the total power generated to spin the votors, according to the inventor's estimate, the excess would provide a large supply of cheap electricity.

Visionary on the scheme appeared when it was proposed two years ago by Julius D. Madaras, Detroit, Mich., engineer (P.S.M., Jan., '32, p. 37), it received the backing of six of the country's leading public utility companies. To test it further, a full-sized rotor was recently completed at Burbington, at a cost of \$140,000, and scientists and journalists were levited the

other day to witness its first public demonstration.

Largest piece of revolving machinery in the world, the gant rotor to whirled smoothly at speeds up to 200 revolutions a minute by no electric motor to its base. Through bearings at the bottom of its supporting framework, its weight rests upon a massive concrete foundation, to which it is anchored by four heavy bars of springy steel that permit it to move a few hundred has of an inch in any direction. Gages attached to the bars reveal the tractive force, or drawbar pull, developed when the rotor is spun in the wind. During a test run, four men, in an

underground chamber beneath the rotor, read the dials every fifteen seconds at the sound of a gong signal

In tests so far made, the builders report, the rotor has surpassed their expectations. It strains at its moorings with more than ten tons' force, indicating that on tracks it would develop more than its rated 1,000 kilowatts of electric power—enough to light 25,000 forty-watt incandescent bulbs. In view of the success of the rotor's trials, its inventor plans to begin construction of a complete wind power plant within a year.

R bbons of smoke, below, show how this model wind retter accelerates the wind stream, treation author that pulls the reter





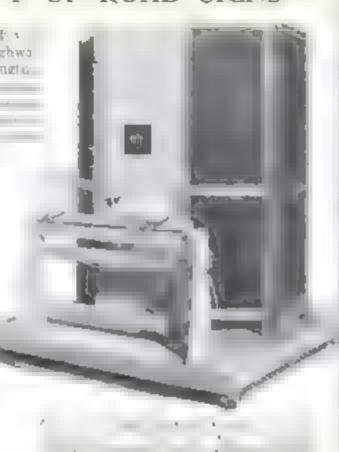
Photo above intenducing the construction of the grant rotor, above the stationary issue framework upon which the rotor throllows. At left, wind conditions near the rotor were carefully mapped with the aid of a fifty fort mast to which five anomometers were stracked to record the wind velocity at tenfort intervals. As instrument on the back of the truck regularized each of their readings.

TEST VISIBILITY OF ROAD SIGNS

The Marke the relative vist for the fierent offers and styles of highwasters ferenal offer us at Washingto D. C., recently put in use an these and testing device. An offer within a summary of the styles of electrically operations shifting shut ers was then placed before his eyes. When the shifts were rapidly opened and the used by remote control free.

dever might get to the section of black on a switch examined the test of characters of quality, when a githree-quarters

412



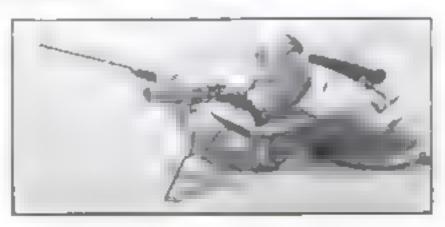


WIND DIRECTION

Using an electric ever on of a weather was a function to a function type has been to a function of the act and of the function of the function

he saine shalt as the vane, arrows a see or less light to pass from a lamp bulb to the

electric eve as the vare swings. The corresponding increase or decrease blues tric current generated by the photose ectric cull a interpreted directly in terms of wind direction on the rail of an electric meter. In the photograph above, the three or is showing where the spiral disk, which he is holding, is mounted in the machine.



TWO BICYCLES HOOKED TOGETHER

t The trime may be made right follows at the real



Note that the same to not rigid but all own some play

NEW SPOTTING SCOPE AIDS MARKSMAN'S AIM

Exert 4.1x designed for use in small bore shooring o enable marksmen to see where their shors his the target, a new spot ing telescope of med um price has then mated on the mark. By a sea tog American optical tirm. The relescope has interchangeable eyepieces, giving a range between twelve and a half and thirty-six powers. It can be used indoors or outdoors.

TIMER SPLITS SECOND INTO 3,600 INTERVALS

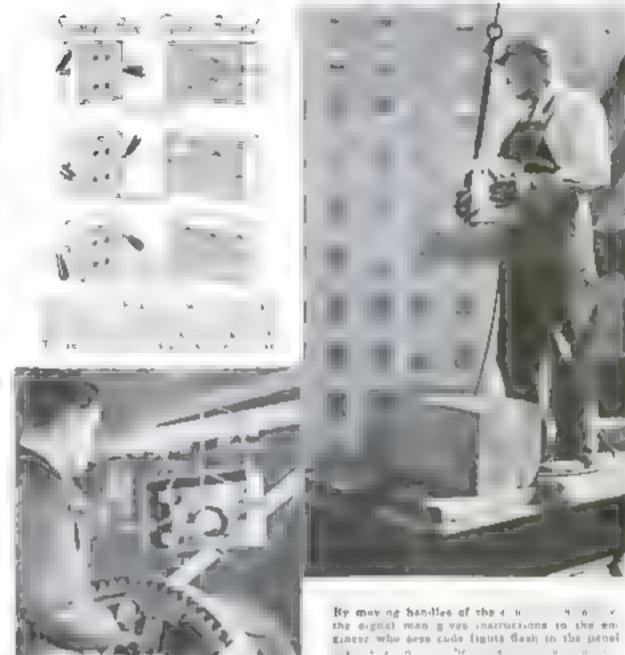
So mast that it can split a single wave of cycle of alternating current, of which there are sixty each second, into pixty separate parts, a high-speed timer developed by Westinghouse engineers is suitable for any task from measuring how quickly a relay closes to determining the time a driver takes to apply his brakes after seeing a stop figural. A disk bearing numbers from one to sixty, representing sixtieths of a cycle, is rotated before a window, and one number is momentarily lighted by a neon lamp connected to the object under test.

BEAD CORD THAT HOLDS

INSPIRED by a list enorment and a long to the lon IN POPULAR SCIENCE MUNTHLY which included an unbreakable bead cord, an Adanta, Ga. inventor claims to have produced one. Within the cord is a strong, sick spring that holds the cord together when the braided cavering frays through, preserving the beads in proper order for re-stringing.



SIGNAL LIGHTS HELP HOIST GIRDERS

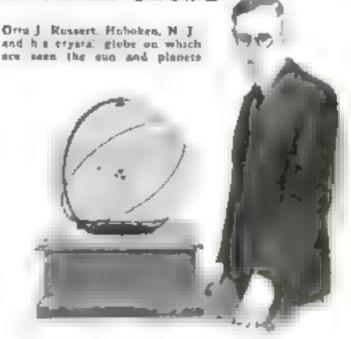


AN ELECTRIC signal system for housing operations on a building under construcion, devised by Ralph Maxwell, New York pronworker, is said to eliminate actidenta due to misunderstood hand or bell signals. The signal man stands at a point of vantage, and gives instructions to the engineer of the hoisting crane by moving the handles of a control box hung from his shoulders. Buttons on the ends of the handles provide additional means of signaling. An electric cable leads from the box to a

panel in front of the engineer, where colored lights flash up in a pre-arranged code and tell him what to do. A gong sounds automatically before each new signal appears. When the signal man releases the handles, they spring back to neutral position and the lights on the board go out, signaling "stop." The accompanying photographs show the new signal system in use during the construction of a New York skyscraper, where it is reported to have proved a valuable aid.

STARS MOVE IN CRYSTAL GLOBE

FACTS of astronomy are easily learned with the sid of a transparent globe devised by Otto J Russert, of Hoboken, N J. The sun and the planets are represented by figares near the center of the globe. while stars are indicated on its circumference by star-shaped figures and dots showing their positions in the constellations. By turning a thumb nut at one corner of the base, the planets are made to move around the sun in their proper or bits at their correct relative pace. The device also will show what stars and planets will be visible from any selected location at any time of the year. The magnitude of the stars is clearly indicated by their size and color,



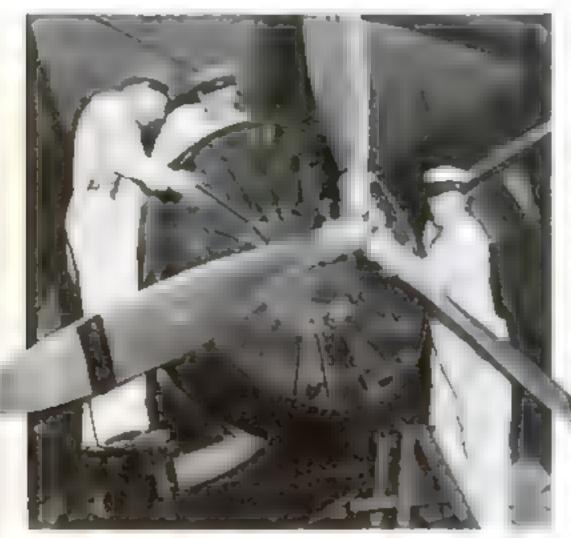
NEW LAMP BURNS DIM OR BRIGHT

Tuxes different degrees of illumination bright, medium, and dim, are obtained at the touch of a switch with a new lamp bulb developed by General Electric engineers. An extra contact in its base,



supplementing the two conventional ones, enables its two filaments to be burned singly or in combination. Designed especially for use in stores, the bulb saves current when the rush hours of shopping have passed and less light in needed. Photo above shows contact that dims the light.

IRLINES kept on BY VIGILANT GROUND



ared with espesial care A 4 c 300 house use 1 cy ste removed and sent to the above

At the end of a run. the prior makes a work ted temper of the condillion of the plane The inspector reads the report and then asks the prior ques-(stimp in order to dietook any in ect howover slight it may be

Little things rece ve the carefulless agention At right a boilt is being tightened on landing gear trunion its rub take them to New York.

PERATORS of arr-transport lines have learned that what an airliner does in the air. depends on what has been done to it in the

50. after every trip, each plane is examined from g gear to wang tips by experienced and keenand before the ship leaves the hangar for r flight each of these famile must be corrected or maintenance mechanics licensed by the Aero-Branch of the Department of Commerce,

Maintenance is not a spectacular branch of airoperation, so it doesn't attract the air-traveling a attention. But it is one of the most vitars in the safe operation of an air-transportation me. Efficient maintenance is costly, but finding and correcting possible causes of trouble before the e has a chance to develop pays big dividends

tely and in public confidence During the first six months of this year, 235 130 gers traveled in the ships of the thirty-two an air-transport companies that operated scheduled passenger services. Of them, 235,042 completed Journeys that average l 327 miles without experiencing even a minor accident. Or the ninety-seven passenwere in accidents, two were killed. A total of over 76 500,000, passenger miles were Over 38,000,000 passenger miles flown for b passenger fatality-a new safe-travel record for the art-

But air travelers are coming to regard safety as a matter of course. Few of them still regard flying as in adventure. They think of it as a way of getting from somewhere to somewhere in the shortest possible time. The Atlanta bound business man who stretches out in his Pul man berth abourd an air liner at Newark Airport at 9 30 in the evening iso't looking for flying thrills. What he is paying for is a safe, comfortable, and uneventful journey, a good night's aloop, and an on-time arrival in the Georgia city early the next morning

That he nearly always gets what he pays for is due, as much as to anything else, to the peverceasing vigilance and care of the seidom-seen inspectors and maintenance crews

Recently I received permission from Eastern Air Transport—an air line whose ships in the last five years have flown 18,000 000 miles on schedule and have carried 210,000 passengers—to spend a night in its hangar at Newark Amport and see just what happens to a possenger plane between flights. The photos illustrating this article were mane during actual operations on a plane that had just finished

A bug, black-bodied, orange-winged Condor passenger ship taxied across the flood-lighted landing field and came to a stop in front of the Air Terminal. Red-capped porters were ready with steps. The cabin door was opened, and a dozen passengers got out and wasked toward the bus that was wa ting to

After them came the pilot and co-pilot, looking as fresh as if they were starting instead of finishing their day's work. A mechanic astride a small tractor appeared, coupled on to the Condorn tail, and with the box plane in tow, chozzed into the hangar.

Schedule

CREWS

By Arthur Grahame

In the despatcher's office, the pilot was just finishing filing in a report form, which he handed across the counter to the waiting thief inspector. Reading the report, the inspector asked questions, to which the pilot replied with brief expanations. The right landing gear brake wasn't working just right, he said, and it seemed to him that the air in the tires was just a little low. That, he admitted with a grin, was all the grief he had to report. The inspector andded, and the pilot went out

These meetings between inspecture and pilots at the end of flights play an important part in the business of keeping the air liners flying. Talks between men who speak the language of the air supplement the written reports, and sometimes avert dangerous

misunderstandings.

Out in the choly, brightly lighted bangar mechanics were busily at work on four of the big blackand-orange passenger planes. Just outside, motors roared as inspectors tested the engines of the slup I had watched come in.

A good-natured maintenance crew chief took time off to tell me something about his job of keeping the ships fit and ready to meet and overcome the

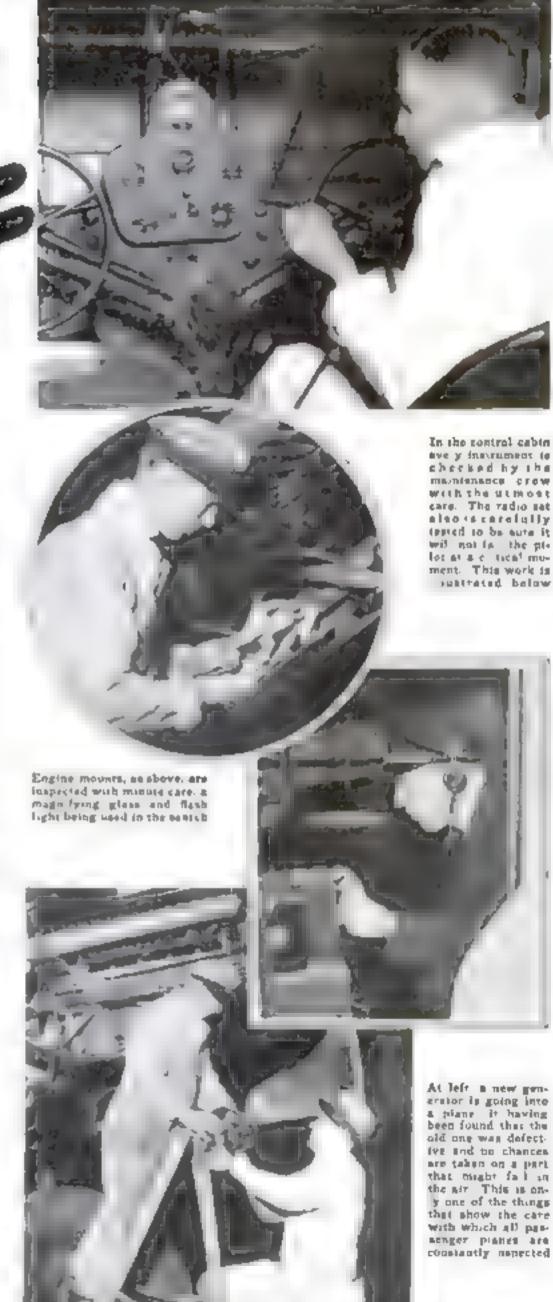
hazards of the air

"It's always watching for the little things, and always catching them before they have a chance to get hig that keeps down the grief in this game," he said. Here's a good example of the sort of little thing that I mean."

He turned over an inspection card hanging from the lower wing of one of the ships, and showed me a notation penciled on its back. "Out on long screw about to rub top of right oil tank." I read.

'Now," went on the crew chief, "that's a mighty intie thing, a screw a quarter inch longer than should have been used up that perticular place. It isn't even a repoir job, because no damage has been done. But if that long scrow hadn't been noticed, it might eventually have rubbed a hole in that oil tank. That might have made a forced landing necessary. And the forced landing might have resulted in a had accident

"The other work ordered on this ship is along the same lines. 'Repair right rear clamp on exhaust stack.' The stack would get loose if that little job weren't attended to. 'Tighten holt in upper trunion of right landing gear.' Two minutes work. 'Check air in tires.' Those sixteen-inch balloons are the biggest tires that ever have been made, and they sure ride nice and easy when they have in them the thirty-five pounds of air they need.



That reminds me that we had a little excitement the other day, when a pilot radioed in that one of his tires was flat. He must have got a puncture just as he took off. No one around here ever had seen a ship make a landing on a flat tire, so we d in't know what was likely to happen. I loaded a half dozen men and a jack into a truck, and went over to the landing field just before he was due

The came in over the field, put his plane down nice and easy and tax est along with all the weight on his good tire. His passengers didn't even feel a bump. As soon as the ship stopped rolling we got a jack under her and had the flat tire off and another one on almost as soon as the people in the cabin realized that anything out of the ordinary had happened.

"That experience taught us that landing on a flat tire doesn't mean a call for an ambusance. Everyone in this business always is learning nomething from experience. That I one of the reasons why flying is getting safer all the time

A long time ago, when I had just graduated to an airplane hangar from an automobile factory, experience taught the a lesson that I ve never forgotten. That lesson was never, under any circumstances, to leave a job on a ship unfaished

work on a mail plane I had just twisted a not on a boot with my fingers, and was about to put in a cotter pin and tighten the nut with my end wrench, when the boss called me. I stuck the wrench in my hip pocket, and went anto his office.

He kept me there for over an bour talking about some work, and when I got out in the hangar again it was long past quitting time. So, never thinking about the nut I hadn't tightened, I put on my coat and went borne

The next morning, when I picked up my trousers, the end wrench fell out of the pocket. The instant it his the floor, I remembered about that untightened out. It was a vitally important out, and I knew that if it had come off while the ship was in the air, there probably was a washed-out plane and a dead plat somewhere along the

route between New York and Washington. And that it was my fault!

"I hursed down to the hangar and telephoned to a fellow I knew at the Washington field. Sure, he said, the ship had got there all right

"As soon as I could say anything, I asked him to go out and fix that nut. And right then and there I made a rule for myself that I've never broken—never, under any circumstances, to leave a job on a ship unfinished. If I d started doing something on a plane, and the prestitent of the company called me, I'd clean up that job before I left it—even if I got fired for doing it."

Outside, the roar of the Condor's three motors had ceased, and the churcing tractor was towng the big ship an act who

the hangar a quere of navigation compl. ated by the fact that the plane had a wing spread of cighty seven feet and that there were four like it already in the hangar

Inspectors and maintenance mechanics, flash lamps slung around their necks, went systematically to work on the liner, Gasolane, oil and water were checked. The water pumps were greased Engine mounts were inspected with minute care, a magnifying glass being brought into use when one of the inspectors detected something that looked like, but wasn t, a crack. Men climbed over the ship carefully examining the wings and the hinges, and surfaces of the controls.

The retractible landing gear fittings the wheels, the brakes and the tires were inspected. Newly charged batteries were installed—all batteries are recharged after each flight. Starters and generators were checked. Spark plags, magneto points primers, and the ignition wires were inspected. All the ship's lights were checked. In the control cabin, every instrument was checked, and the ratio set carefully tested. The duralumin propelers



As soon as the pustengers have at ghird a tractor town the big plane to the hangar

were looked over with care

Each of the more than thirty items listed on the inspection form is aigned for by the inspector who checks it. When there is additional work to be done, the inspector makes a note of it and the mechanic who does the jub signs for it when it is completed

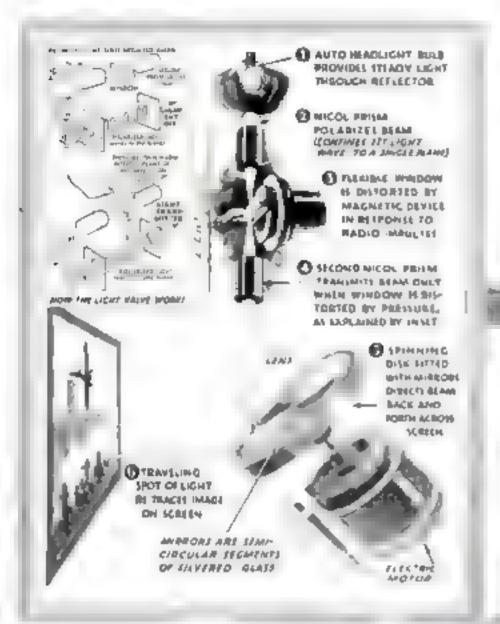
So when the prior takes over the ship for its next fight, he has a right to feel confident that it is alreadily in every respect

Although (Continued on page 88)



New Television System

ADOPTS UNIQUE METHODS



Units of the new letevision receiver are shown in photo. bring attembled for Inboratory test The small scanning disk in designed to project & large image



At laft in shown the mab of gunneske motorial through which the sight passes. It is moninted on a plunger that moves up forc ng the alab gots adl janeggs teen in the conter of the pictore Thus thu th n alab is used as a light valve

I lustration above shows mechanism and manna of operating the new priorision aystem designed by a New York inventor

ESIGNED to throw images on a large screen, a television receiver based on new principles is buing developed by William H. Peck New York inventor and former U. S. Navy optical expert. In each of the features common to all television receivers, a lamp to provide illumination, means

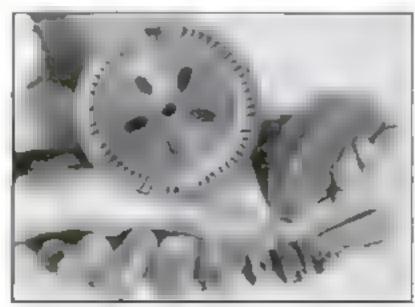
for varying the brightness of the beam rapidly in response to radio impulses from the transmitting studio, and an optical system to swing the beam back and forth across the screen to build up images, the new set utilizes novel methods

A standard suto-headlamp bulb is substituted for the neon tabe of the usual television outfit in order to produce smable brack-and-while images, instead of amad pinkish ones that must be magnified. The light of the headlamp bulb is augmented by a special reflector

Since the headlight bulb cannot theker with extreme rapidity. as a neon tube does, its beam is passed through a transparent



A sia volt automobile bulb is used with refice our that intent by the light many times



Close-up of the stanning disk and several of the mirrors

window that is part of a mechanical light valve. Meanwhile a device resembling a dynamic loudspeaker, actuated by incoming radio impulses, subjects the window to fluctuating pressure. When the window is distorted by pressure, a bright apot appears on the screen. When the pressure is relaxed, the screen is darkened.

This is accompashed through the curious property of certain substances, such as glass and gelatin, of twisting a sheaf of polarized, or flattened, light waves, when distorted by pressure. Probably this

is the first time an inventor has harnessed, for popular use, this

obscure laboratory phenomenon. To direct the light beam back and forth across the screen of the receiver scanning its surface, Peck employs a mirror-studded disk whirled by an electric motor. The microry are smoothly cast, semicircular segments of glass, silvered on the base, and mounted in a circle in such a way that the points of reflection are arranged in a spiral pattern.

This results in such high optical efficiency, according to the inventor, that the new television receiver will throw so bridant an image on its screen that the pactures may be watched in a

(ally 1 duminated room.

RADIO TYPEWRITER USES MICRO WAVES

Typewriters by radio, on the newly exploited ultrashort waves, is a new method of communication heralded by apparatus already being developed by a New York firm. By this means, a stenographer at the central office of a large industrial concern could transmit mesiages simultaneously to other parts of the piant or to branch plants in distant enties. Thus copies of business documents are instantly available wherever desired. Other applications are foreseen, for example, a reporter sitting at the transmitting typewriter could write on ten or more typewriters situated at distant points; while a state or city police headquarters could similarly communicate with police outposts or cruising radio cars.



BULLET FROM EACH GUN

SOLD TO GO TO POLICE

FINGERPRINTING every revolver was recently suggested by Dr. William B. Rayton before a meeting of the American Prison Association, According to his plana bullet would be fired through every revolver after manufacture and filed wath the police. Bullets in murder cases, which had been fired from unknown guns, could be compared by bal istics experts to these test bullets, thus tracing them back to the guns which figured in the crime,



Here a the machine semilar to the transmitting machine at upper left, that rece were the messages sent by much radio waves. It operates at any distance from senting station

ONE-WHEEL TRAILER STEERS WITH CAR

Rining on a single wheel, that is steered in unuson with the front wheels of the car to which it is attached, a trainer occused by a Los Angeles, Cahl acceptor permits a driver to back or corn at well

w thout thought of the load behind. The trailer couples to the automobile's rear bianper, and the rods connect its wheel to the car's steering mechanism. It is easily attached to any type of machine and can be readily disconnected



The single wheel on this trailer connects directly with the steering gear of the car so that turning the steering wheel guiden the trailer in backing or turning the auto



OF BOTTLE CAP

FILLING & drawing pen or an artist's brush is samplified by a patented automatic bottle cap that pumps ink out of the bottle into a tiny reservoir, where it is transferred to the pen or brush. Excess ink drains back into the bottle. The operation of filang requires but a second or two, and is performed by pressing a plunger on the cap in addition to simpulying the filling process, the pump saves ink by preventing evaporation and spilling and also, there is less chance for the pen to gum up.



SHIP models of paper, that sail like real vessess, are the invention of L. P. Hall, Jr. Morristown, N. J., engineer, who has applied for a patent on his method of construction. The material used is a standard grade of heavy jute paper, or tag board, which is die-cut in the desired shapes. These are supplied in hits for home model makers, who assemble the parts with glue. The hull is treated with a waterproofing solution, applied with a

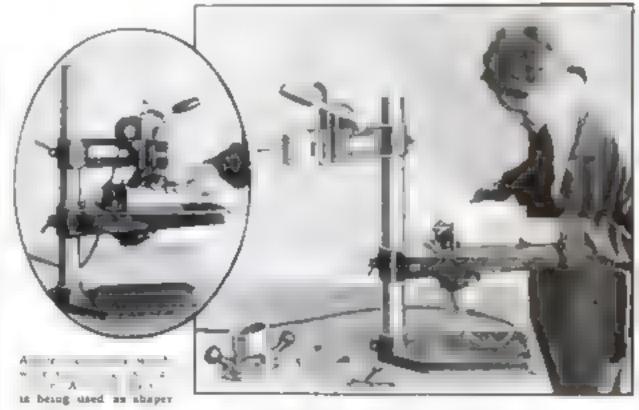
brush, while the sails are also waterproofed by applying a thin coating of the same solution with a brush on each side. When completely assembled the model ship presents an extremely light and rigid construction, due to the stiffening effect of the waterproofing material. Its paper ske qualities desappear and its characteristics of huoyance probably resemble those of a real boot more than those of any other model type. Because of its lightness, the model shows great speed in the water. A typical model requires from six to eight hours to build.

LIPSTICK AND WATCH COMBINED IN ONE

Water and lipstick are combined in an unusual piece of craftwork produced by a Hollywood, Calif., jeweier. Each time the user of this two-in-one accessory reaches for her make-up, at she prepares to keep an appointment, the hands on the diminutive dial remind her how many minutes she has at her disposal Originally created as an accessory for use in a movie production the historick watch is claimed by its designer to be a useful accessor to any handbag



A watch is set in this new lipstick holder so that the uner can readily tell the time



TOOL AIDS WOODWORK IN HOME SHOP

Decorative woodworking that has hitherto been beyond the reach of the average home-workshop enthusiast is made possible by a new electric router and shaper, recently placed on the market. With its sid, the amateur craftsman finds it easy to embelish his handiwork with delicate inlays, beading, veining, and dovetail or mortise-and-tenon joints, as well as to perform thousands of other woodworking operations. An interchangeable power unit makes pos-

sible the purchase of either a hand router, bench router, or bench shaper, and the later addition of the other units. The shaper has a patented tilting motor unit holder that not only makes possible the use of small-diameter cutters for molding cuts but also makes possible the cutting of almost any contour with a limited number of cutters. With only four cutters it is estimated that 600 different moldings can be made. The drive from the 110-volt, universal electric motor is direct

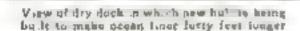
Increase Liner's

STRETCHING a transatlantic liner to make it forty feet longer is an unusual engineering operation in progress at Hamburg. Germany, where the steamship Hamburg is being enlarged to provide add)tional passenger and cargo space. Three other vessels of the line are soon to be altered similarly. To do this, the ship is placed in dry dock, where its bow is cut away. A longer bow is then electrically welded in its place Joning the two parts involves remodeling the bulkheads.



Loss Hamburg in the background with its old his our away and ready to have the new and longer had even in the force band, a led and lien as unnestly worken to decka and plates

Length by Stretching



LOUDSPEAKER IN TRUCK WARNS OF CAR BEHIND

For petvers of heavy trucks with noisy loads, who sometimes are unintentional road hogs because of inability to hear the honking of a car behind, a French inventor has designed a loudspeaker telephone system. A transmitter at the rear of the truck picks up the sound of an encoming car's born, and wires convey it to a loud-speaker beside the driver. Hearing the blast of a horn at his ear the driver knows there is a car in back of him and puls over to the side of the road,



New grainless tubeleans in the form of a stick, is being applied to a sticky car door

GUARDS ON MOTOR BIKE PROTECT RIDER'S LEGS

To protect a motorcyclist's legs from



GREASE FOR CAR DOOR NOW COMES IN STICK FORM

For curing sticky automobile doors and s neaking hoods a new lubricant in handy

The stick is forced from its metal case by



How Mirage Paints Images on Sky

Natural Phenomenon Recorded by Camera on Hungarian Plain



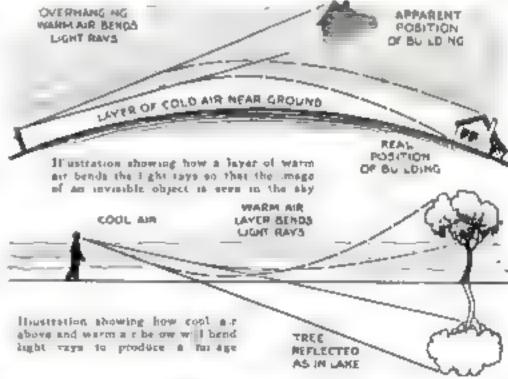
Righ shows the horizon line, which is seen the center of the picture the observers and a landscape appearantly resting on his

Remarkable photographs of mieages, believed virtually the first of their kind ever made, have just been obtained by an enterprising photographer at the town of Debrecsen, some distance east of Budapest Hungary. The views of which three of the most stribing are reproduced on this page, may prove of considerable scient in value in a usy ng one of the strangest of nature's phenomena, Few places in the world are

hetter suited to the observation of mirages than this Hungarian lowland on almost level plain rimmed by higher land. Strange apparitions appear above the horizon as the sun breaks through a morning mist. Greatly magnified, church steeples and houses of Israway villages appear in the sky high above the horizon. Even distant carriages and ra-load trains, normally invisible, come into view as funtastic specters. Sometimes the visions appear half submerged by water, as in a flood. The explanation of these strange images is to be found in the fact that layers of hot and cold air, having different refracting or light-bending powers, may deflect rays of light reaching on observer from a distant object and give a false imprension of its distance and size. The particular effect produced depends on the special atmospheric conditions as illustrated in the two accompanying diagrams. In some cases the air layers act like a telescope lens and enlarge as well as elevate distant objects. Both of these very remarkable misage-creating conditions are clearly explained in the two illustrations that are reproduced at the right



Thrown not the sky by deflected rays of I ght the images in the background of this remarkable pleasure were need by the men in the foreground, as the comora caught the unusual scane





Many miles away, this train was seen reshing along, leaving a trail of smoke against the sky. In reality it was far below the horizon

JANUARY, 1934



Milky Way Found Source of Cosmic Radio Waves

Mystektous mile menns that teach the earth from the Miles Way are being and by Dr. K. G. Jandey, Bell page. Laboratories engineer, with his

ago, they have been identified as of 14.6 meters wave length, and can be picked up in a suitable receiver as a cosmic biss which was recently carned by land wires to an audience in the American Museum of Natural History in New York. The direction from which they come has been investigated with the serial, which is re-

goes that under these circumstances the maximum strength of these waves would seem to come from the center of gravity of the galaxy itself. However, the actual cause of the waves remains a mystery It is this mystery that is to be investigated with the aid of new instruments.

With these it is hoped to establish definately whether the waves travel direct from the stars to the earth, or are generated near the earth a atmosphere by bombordments of cosmic energy

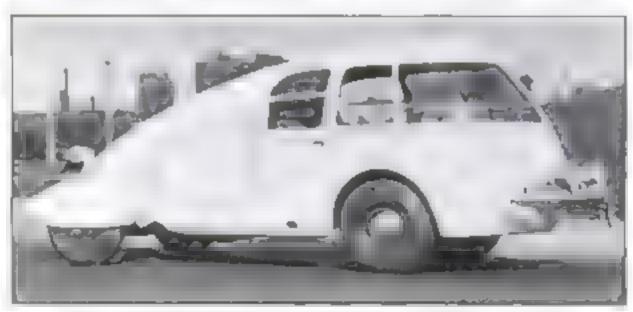


FLASH-LIGHT POINTER FOR USE OF LECTURER

To Aid lecturers in drawing attention to figures on a blackboard, a flash-light pointer has been devised by Westinghouse engineers. A bulb at its tip is supplied with current from a battery within the hollow steel pole, and is illuminated by pressing a switch in the handle. The flash-light is said to help focus the eyes on a particular point.

NEW STREAMLINED CAR HAS FRONT DRIVE

COMPLETELY streamlined, a new teardrop car, demonstrated in Chicago, is reported capable of ninety males an hour. In test runs at a mile a minute, the normal tendency to swerve on passing large trucks because of the vacuum produced, was declared absent. The motor, at rear, drives the car through the front axle,

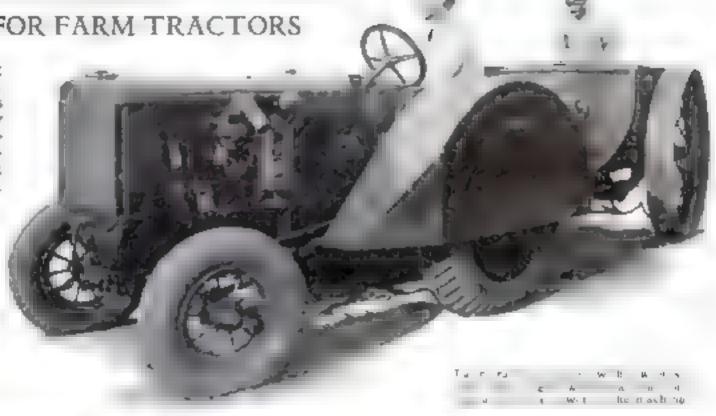


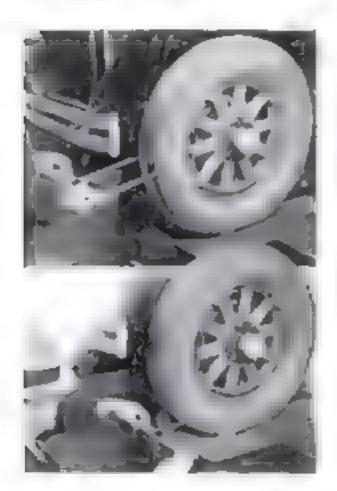
Fully streamlished, this front-drive car is said to hit a ninety-mile an hour speed

LOW-PRESSURE PNEUMATIC TIRES DESIGNED FOR FARM TRACTORS

Designed especially to meet the requirements of the farm, any pressure pneumatic tires for tractors have recently here introduced A tractor futed with these tires can operate not only in the field but also on the road, around the

barnyard, or an any of the buildings. The special rubber compound used is designed to resut phrasion, cuts, and snags incident to field work. Weights are provided to be added to the wheels for service where heavy loads cause a tendency to sl.p. The tubes have offset valves inserted through the rim's side





NEW GAGE MEASURES BULGE OF AUTO TIRES

MEASURING the bulge of an automobile tire, instead of the pounds' pressure of air it concains, is a new guide to tire inflation introduced by a burge gage just placed on the market. The makers contend that it is the actual amount of deflection of a tire under its load that determines its afe and its easy-riding qualties, and that this burge should be equalfor all the tires on the car, while the air pressure may properly vary according to the load on each wheel Used like a pair of coliners, as shown in the illustrations above, the new gage is pre-set for a standard deflection and serves as a ready check while the tires are being inflated. A standard bulge line is indicated on the gage and t' is this mark that guides you in checking the bulge of the tires, the first measarement being taken at the beight of the wheel a hub-

WORLD WAR MINE HALTS SALVAGE WORK

EFFORTS to recover \$10,-000,000 in gold from the sanken fraga e Lutrue off the Dutch clast were light ed abruptly the other day by one of the oddest of marine accidents. Interrupted by beavy seas, salvagers were about to redescend to the constal caisson in which they were clearing sand from the derelict (PS M., Oct 3) p. 16), when a mysterious explosion rocked their rax The cone was hauled up and found torn apart. Suspicions of subotage by a disgrantled former employee or by rival treasure hunters vanished when an official investigation thisclosed that a drifting mine, dating from the World War had collaged with the cone and exploded. The strange accident has postponed further savage work until spring



This steel cone, used in salvaging a fortune from the seqwas ripped open by the explosion of a World War bomb-

AUTOMATIC TYPEWRITER COPIES LETTER



As MANY as 100 copies of a form letter, indistinguishable from an individual letter, are turned out hs a new automate typewriter, as quickly as the most skided typist round wire one. The letter is first typed on an appliance, at left in photo, that produces a master roll like that of a player plane. This roll is fed into the automatic typewriter, at right in photo, which operates by electricity. The typist has only to insert the address and salutation. The machine does the rest.

Near a girle' academy, a tactorist got a fix a tark and chembed gut to su-amine it. As he d d to, an acrow, shoot from the archery tange of the school, sipped by and took a but out of his car.



Queer Things that happen to people in AUTOMOBILES



By Edwin Teale

A runaway airplane hurdled a hedge god landed ups de down on aparked mach ne. This is only one of the mapy arrange accidents that occur to auto drawers.

EAVING a thin trail of gasoline behind, an automobile
with a leaking fuel tank
rolled down the main street
of a Massachusetta village. A few moments after it had passed, a smoker flipped
a cigarette stub into the street. It touched
off the inflammable trail. Fire raced along
it, caught up with the car, ignited the fuel
tank and sent the machine up in flames!

In Carlornia, not long ago, a highway expanded with the heat and buried a motorist, machine and all, into the ditch. Under the sun's rays, the material had buckled at one of the tar-filled cracks, wrenching the car dut of control.

For three days in succession, a Wisconsin motorist had trouble with his engine. He was staying at a summer camp, driving in to work each morning. On all three days, the cause of the trouble was the same. Squirrels had hinden acoms in his carburetor?

Thus, day by day, strange, unexpected, almost incredible experiences befall American motorists. Insurance company files, police blotters, and service station records are crammed with chronicles of weird accidents

A frightened jackmobst jumps through the windshield of a tourist's car in Kansas. A runaway ampiane hurdles a bedge and lands upside down on a parked machine in Connecticut A falling meteorite crashes through a radiator in Indiana. A driver's wooden leg carches on tire when two cara hump in Canada.

Twenty tive million automobiles ride the highways of North America. There are eitht cars for every mile of road in the United States. Bithons of miles are covered annually at high speeds. So anything can happen when Chance takes the wheel

To the list of astonishing things that do happen, every state in the Union makes is contribution. Consider half a dozen such recent reports!

Georgia. Almost in the shadow of the Stone Mountain Memorial, a wagon carrying three men and pulled by two horses, was struck by a speeding auto. When the dest settled, one of the horses was sitting in the wagon, one of the men was perched on the back of the other horse, another of the men had been thrown through the side of a house and a buckle, flying from the broken barness, had struck a bystander and knocked him down a thirty-foot embonkment. Even then, the excitement wasn't over. A spectator, rimning to belp, tripped over a root and broke two ribs!

Arisona During a heavy wind-storm at Phoenix, F. L. Lepur was afraid his new sedan would be damaged. He steered into the protection of the lee side of a building under construction. Hardly had be shut off the engine when down rained a quarter-ton of bricks. They smathed in the roof, bood and fenders of the car, causing the only damage done by the storm in the storm.

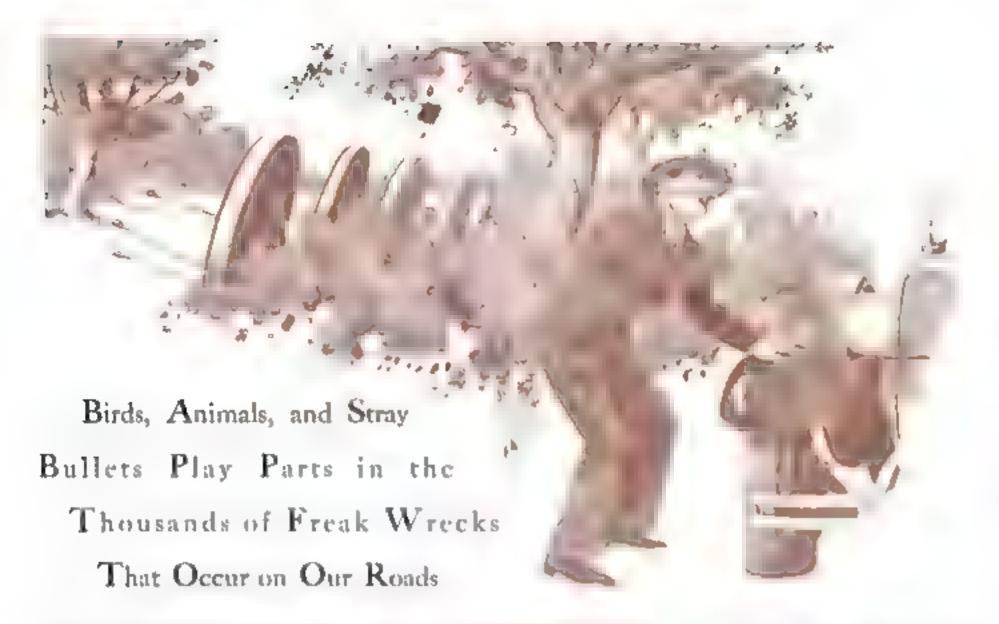
Wisconsin. Preparing to make a left turn just outside of Platteville, James Rickard stuck out his hand. Whizing up from the rear a speeding machine struck it and broke his arm.

New York. Just as he passed a girls' academy, near Norfolk, Harold Green felt his machine bump along on a flat tire. Climbing out, he bent down to examine the wheel when a zipping arrow took a chunk out of his ear. It came from a near-by archery range where the gar's were shooting at targets.

Florida. Accidentally leaving her car in sear, Mrs. Lucille McGirt got out to crank the motor. The car started her dress caught in the crank, and the machine.



As sight of a hall, a motorist stopped but the bull butted the muchase back fifteen feet



crashing through a wall, carried her into a doctor a office.

Himois, When C, Miles MacDonald backed his car out of his Evanston garage and headed down the atreet, he was started by broodcurding cries coming from in front of the dashboard. Jamming on his brakes, he leaped out to investigate. As he lifted the hood, out abot a grave, eye cat which had been impresoned with a

Often animals cause the freak acceleris and unusual experiences which motorists

mee on the public roses

Three Pennsy varia deer hunters packed their equipment in a touring our and set out for a camp 200 miles from town. On the way a deer charged out of the underbrush ran point-brank in a the speeding auto and all three bunters were k lies.

Not far from Prince Fredericktown, Md another motorist met a bud planted square y in the middle of the road. He slowed down and stopped, The bull anorted pawed the ground and charged, butting the nato fifteen feet backwar! Before it could charge again, the astomshed motorist wheeled his car around and stepped on the accelerator

Another curious crash, caused by a twenty-pound shapping turtle, sent three cars to the garage for repairs at Pattsfield,

Mass., not long ago.

George B. Maddocks was returning from a fishing trip with the turtle tied up in the back of his car. On the ourskirts of the city, it worked itself free, crept over into the front seat, opened its beak and snapped at the driver's leg. With a yelp of pain, Maddocks tried to pry the turtle loose and in so doing lost control of the machine and struck two other cars.

Even more surprised was Henry Liggett, of Phoenix, Aria, when two battling owls gave him the scare of his life. Shortly after dusk, he was trying out his new



CAR LOOPS THE LOOP. A said, shifted up off a bridge turned a complete somewax a nithe a rand landed, right saids up, on the ground farry lest below without hallong either the driver or his passenger.

sheed burst into fragments and he was showered with class feathers and fur Assoon as he could stop be found in the sent beside him two buce own socked in a death struggle with a rabbit cliniched between them Fighting over their prey they had flown into the windshield.

Then there is the bizarre case of "Wizard Smith, an Austragan sacing driver who was almost kined through being struck by a feather" In 1930, Smith was making a speed trial over the hard-packed stretch at "Ninety Mile Beach." His low-slung sacer was burning up the sand at 148 miles an hour when it struck seven sea-birds. Feathers flew over the windshield. One struck Smith in the face with an impact which nearly bunded him and it was only by a bair's breadth that he avoided a fatal crash,

A few minutes after eleven o'clock, one August morning, a Missouri farmer and his wife were bowling along a highway near Odessa on their way to town, Suddenly, the car careened across the road, sidewiped another machine, and piled up in the ditch. A blinding, stinging cloud of bees, swirling madly after their queen, had entered the open car and swarmed on the face of the driver! Naturally, he lost control of the machine

A second cursous accident in which bees played a part occurred near Tulare, Calif. Two colliding machines were only slightly damaged and no one was hurt. Yet traffic along the highway was used up completely for a whole afternoon. During the rest of the day, traffic officers were busy warning motorists to detour until sundown when the angry losects returned to their hives on one of the colliding machines.

The thought that he had been stung by a bee was the first that occurred to Thomas Pendergast when he felt a sharp pain in his nose as he drave down a street in Brooklyn. N. Y. Then his nose began to bleed and would not stop. At a hospital, a doctor was examining his nose when Pendergast coughed up a bullet. Its force practically spent, the lead had entered his nose and had been breathed back into his threat.

Another Brooklyn bu let produced a fantastic climax to a two-mile race with a bandit car. After the pursuing officer bad fired a shot (Continued on page 100),



How Astronomers Find

If a man a head were an large as the earth no that one eye was at Berl n and the n her at Cape Town, he could by that ng first one eye and then the where see the moon at different places among the third at is and used in the trustration. This apparent shift of year the a called "pate at" and astronomers use it so find distances. See photos at bottom of page

Star Distances Star Distances A 28 85" m les from the carth, you not arrible wonder how it is a carth, you not a carth wonder how it is a carth which wonder how it is a carth wonder how it is a carth which which wonder how it is a carth which wonder how it is a carth which wonder how it is a carth which which was a carth which which was a carth which which was a carth which which we will be carth which which we will be carth which which which we will be carth which which which which we will be carth which which which which

s 238 85" m les from the carth, you naturally wonder how astronomers are able to measure accurately such a vast distance across empty space—more than nine and a balf times the maleage round the earth at the equator

Your wonder about the process of measurement grows when you learn that the nearest of the fixed stars, Alpha Centauri is 25.600.000.000,000 miles away, or 7°5 000 times the distance of the earth from the sun?

Net the method astronomers use to measure these tremendous distances is really simple, and can be illustrated by merely opening and closing the eyes atternal ev

As I look out of the window over my desk I see beyond the custam cord, a bouse across the street. When I close my left eye, the curtain cord apparently hangs to the left of a critain point. When I open the left eye and close the right the cord seems to jump across to the right side of the same point. This apparent change in the position of an object when viewed



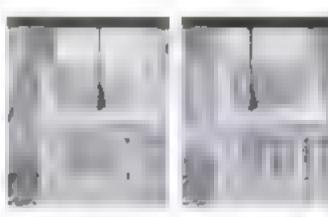
How Distance Decreases a Star's Parallas

A yardstrick in art up on a table to which a card, with two holes in it and a notch midway between them, has been attached as it above above betup a tiret a screw and a bot at five ten, and fifteen inches, respectively. Irom the card hight through first one hole and then the other and write down the jos trina of tiret acrew and bolt as read on the yards at You will find that the difference in a verteadings will be twice that of the screw and three times that of the bolt. This proves that the peralian decreases as star's discance from observer increases.





Looking out of the window with the left eye closed, the curtain cord will appear as in the picture at the right. With right eye closed cord jumps to the right



In this experiment, stand a few feet back from the window Classing first one eye and then the other now displaces the cord batt as much as in the first test



By

GAYLORD JOHNSON

from a different standpoint is called paraliax,"

If I get up from my desk chair, move back a lew feet into the room and try the caperiment over again, there is an important change in what happens. Alternately opening and closing my eyes then causes the cord to move only about half the distance it did before

The farther I move back from the window, the smaller the distance the cord seems to move across the background when I open one eye at a time.

This simple experiment gives the principle astronomers use in determining the distances of the moon, sun, and stars. Let us see how it is applied practically in finding the distance of the moon

Imagine a man of such huge use that his head is as large as the earth. Then think of his two eyes as two observatories. One of the observatories is located at Berlin, Germany; the other at Cape Town, South Africa. Also, imagine the tassel of the shade cord to be replaced by the moon, and the view out your window replaced by the fixed star groups.

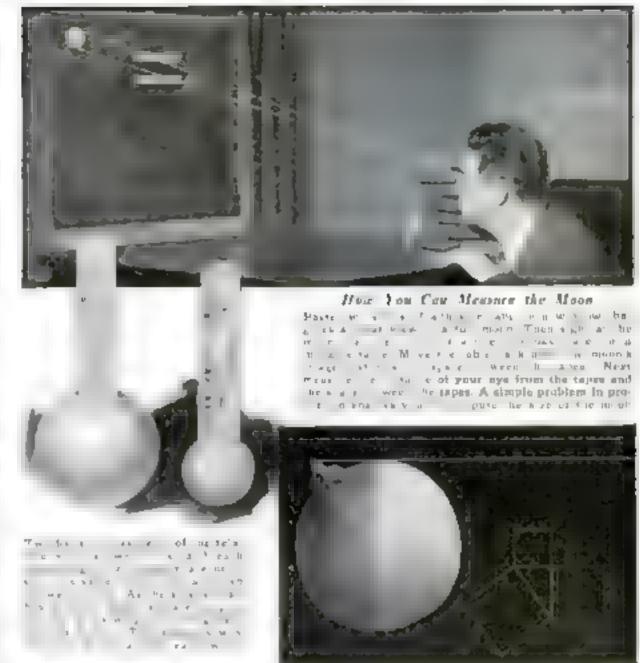
Let us suppose that when the grant closes his Cape Town eye he sees the moon at the south of the group of stars talked the Pleiades. When his Berlin eye is closed the moon will apparently jump to the north of this star group

The angular dutance between the two paces where the moon accus to be when viewed simultaneously by observatories at Berlin and Cape Town is used as one angle of a triangle. Two sales of the triangle are he lines of sight from the observatories to the moon. The third side is the line that ourse the two observatories, running straight through the curving earth.

This short side of the triangle is of course known accurately, and the three angles of the triangle are also known. By using a simple rule of trigonometry istronomers then find it easy to calculate the two missing sides of the triangle, which of course gives the moon's distance from the two observatories.

We have not merely imagined this case of the two observatories, for the British Government established the Royal Observatory at Cape Town primarily for the purpose of finding the moon a distance in collaboration with the Berlin observatory

Observations of parallax made from two joints, or eyes, in different parts of the earth do very well for measuring the distance of a comparatively near object like the moon, but they would not do in calculating the distance of the nearest fixed star! For this purpose the two eyes must



Measuring Reight of Moon Monutains

To find the height of moon mountains, an astronomer measures the distance from the line between the light and dark parts of the moon to a mountain top just twicked by the sun a rays. This distance, along with the known radius of the moon gives him the two sides of a right and of it angle. Then it is easy to compute the third a da from which he subvents the moon's radius and thesi of course will give him the height of mountain

Models at left show how the moon may have been tota away from the earth. As No. 1 cevolves it gradually takes the form of No. 2. Later the ends separate as is No. 3 Further revolution remaids each some a sphere as in No. 4. The Pacific Ocean may fill the hole left when the moon few off

be placed just as far apart as possible How far apart can our two standpoints be placed? The longest possible distance that we can put between two observations of a star's position is, obviously, the entire width of our earth's orbit around the san. Several months must of course elapse between them. This distance, about 186,-000,000 miles, is accordingly used by astronomers as the short side of the triangle when measuring the parallax of fixed stars.

It would seem that every star in the uni-

verse must show a large shift of position when the eyes viewing it alternately were 186,000,000 miles apart, but some stars are so infinitely remote that they show an shift that can be measured. Even Alpha Centauri, the nearest fixed star, shifts less than one thirty-six hundredth of a degree, while the earth moves from one side of its orbit to the other.

If you could see a mere pin point of light eleven miles away, and viewed it alternately with right and left eyes, the difference in its apparent direction would be just the parallax of Alpha Centauri, This gives an idea of the accuracy needed to measure the distance of even the nearest fixed star.

An experiment you will have fun trying enables you actually to measure the moon's diameter. The only apparatus needed is a (Continued on page 97)



This diagram, drawn accurately to scale, shows you the real orbit of the most around the earth, which, as you see, in alightly wabbly and always concave to the sun

New Methods for

Care of Dogs

Upset Old Ideas

EVEN pointer pupples dashed from their kennel at the crack of a rifle shot. They rabbed their tiny noses against their master, unafraid, ready for the big adventure.

Several weeks later as they raced through the nearby woods trile shots and the isom of a shot gun echoed through the trees. Each puppy received the signal calmy hancel testar by any stood pointing toward the direction his master was facing.

They had reached the high-school stage of their training which had started in early surpyhous when heir owner signater meal one with he crack of a whip, loght and tinally end showing diswession due course as the dogs became accustomed to these unusual sounds. Whip and tifle meant to them some hing interesting not semething a fear and all this preparation was to keep them from ever becoming gunshy

Many unlovely traits develop in dogs simply because of the master's carelessness. Gunshyness is a case in point. In most cases even this care is cured if the owner

is as importable and war a party enough

I hete is no teason why has habe's should levelop in certain breeds such as ganshames and hard mouth in bird ones. These trees depend entirely upon environment and the owner. Other toers are can as wrong. Collars cause gotters you are told taw men hakes a dig vicious, the mouth of the purespred dog always has a black roof; you cannot wosh a puppy in safety during the first six months, a misacience in the passare runs a female for all time. Si ly ideas?

A few simple precautions will enable you to raise healthy and happy dogs and enjoy them to their ripe old age. Also they will make it possible for you to develop in them baints of clean ness, in department that will be a pieasure in your absence of make it will be a pieasure in your absence of make a pieasure of your absence of make a pieasure of the pieasure should be a make a pieasure to a

Mentally every dog is very much what you make him If brought up from puppyhood in an unchanging house-bod be gets to and its and the form a way sund wishes and in time was a hipt basself to his master's person any devoting himself to his master after. On the other hand the mature dog that has known several mosters has acoured some of the individuantly of each to the confusion of his own

The earlier you and your dog come to an understanding he better for both. It is well if in the organing he come to you with no objectionable habits or vices to be an earned. It is much easier to school him to a new habit than to cure him of an old one.

One of the greatest joys an an mai lover can know is the manifestation of loyalty exhibited by a dog he has reared from halvhood. Don't kill your dog with kindness but teach him you are in he trus ed.

Before the litter arrives, feed the expectant mother normally, say, one good meal in the evening consisting of raw round steak or hamburger mixed in equal parts with bran or other roughage. It she has some favorite food, give her that. A small meal will meet the morning's requirements,

STRIP DON'T CLIP, YOUR DOG

In the picture above \$ cott a se being strepped. In this process, the old has a are pulled nor without some and purchase but the average and without necessary protect on severy protect on

C assum, above, shows how to true the dug a toens is if the new sure permitted to grow long you will pay the panalty in comings and in appeal all k stockings.

A pale and pair east mustle for your dog in shown at the right It a made of four-inch ourgeon's geore as described in the test It will not bind but will keep the mouth closed and to better than a reather mustle which is too hard and too beavy





By H. M. ROBERTSON

The three-aided bed he now with a mattern fixed with cedar abayings as sized for the number on the size of the project on from drafts and at the same time affords much labory.

She probably wal refuse food during the last day and whom, he her own be. Do not a or help in his, but previous her with the necessary materials and let her go phead with her own plans. Get a box or a large cardboard carron and cut a siberal opening in one side three inches from the horton. This will be now enough to permit her to go and come wet will be high enough to nevent the pappies from straying away.

Place several sheets of newspaper in the box. She will tent these up to said herself. Do not, under any a reumstances place blankets or old coothing at her disposal, as the young may craw, underneath the fotoit or and an arm or pocket and suffocate. After both remove the orn papers and date new ones in the box. They will not be term again.

If you have a yard where the prospective mother will may no not permit her to dig a hole under the house or garage. Despite any other preparations, she would be sare to have her biter there

Nothing more will be required during

the first four or five weeks, except in the case of terrier or spaniel puppies. Custom decrees that these, and a few other breeds, shall have abbreviated tails. When they are three or four days old you may cut their tails. Use sharp, sterilized scissors, paying no attention to joints or the socalled necessity of tying to prevent bleeding. Centrary to general benef, this is a painless operation and little or no blood will flow. Cut, and do nothing more.

The mother will wear her brood when they are about five weeks old. Then you should give them a det of raw scraped beef mixed with bran. A week later some mild vernafuge will be helpful. For this purpose, a little garin or

f one of several puppies suffers manufaction, take him away from

manufection, take him away from the others. He usually will need vitamines, the absence of which in his feed has been weakening his bone structure. It may be that calcium phospha e will fill the yead. In addition

to his meat thet feed him plenty of raw eggs together with cod-liver oil. Prepared charcon in the morning will aid the digestion. Some authorities say a little sogar added to the food will help conquer or prevent nekets.

Dogs of all ages need exercise and plenty of food and water. Food should consist of one half roughage and one-half risk meat. Always remember that the dog is a carriverius animal and must have meat. He will digest fish eggs, and meat in their entirety. The roughage may consist of vegetables, bean toast or some of he prepared wheat products.

These of course provide for his physical are. There is another side which I shall call the psychological for dogs, ake

homans, require a certain amount of freedom. Even granting that purpose are born unequal physically and memally their environment and the care and kindness with while you rear them netermine their discosition at maturity. Don't keep them cooped up in a kennel or in the house Permit them to see people carly, take them out on he street or for drives in the family au emobile. As a rule only those kept eternally chained have vile uspositions.

Deprive in an mal who ly of his therty and he may develop fears and phothas that will bring heartaches to you la er. He learns early to associate ideas. This is especially true of sounds. Formers and setters particularly should be moken to their adoited in smoon white young. No

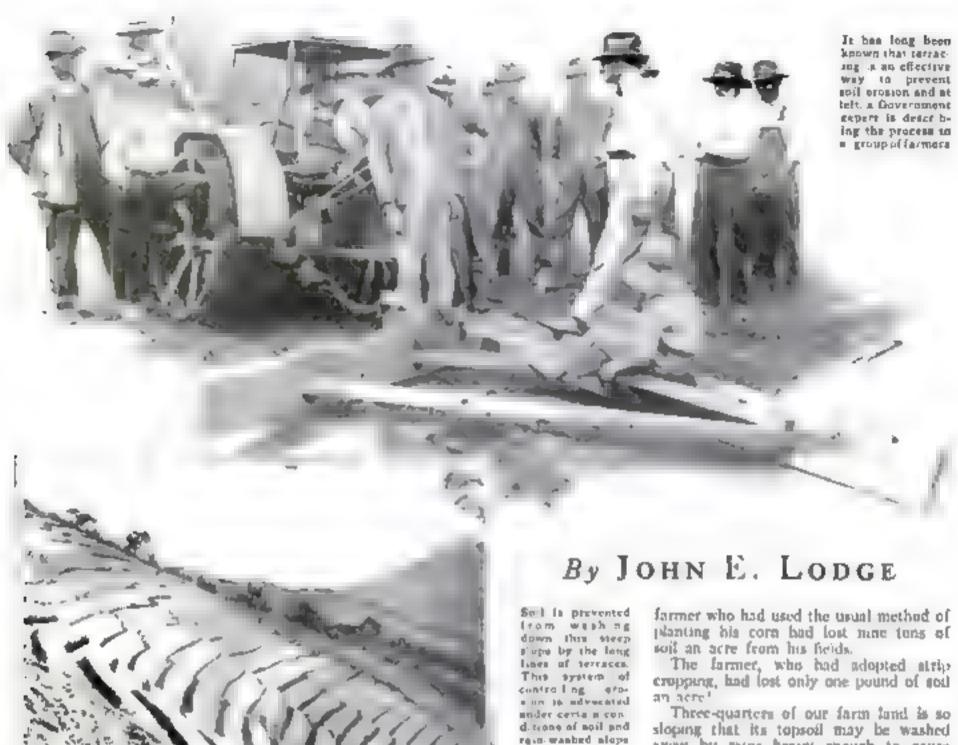
dog should be permitted to run wild during the first twelve men his if you expect him to be endowed with perfect manners and a tender mouth. In act training for the field should begin at seven months of age.

No bad babit can be cured by adding to the anima 5 woe. It merely becomes terror stricken, ruined for all future good. I might add that whipping is a mistake tinless you catch the animal directly in the wrongful act and apply the punishment immediately. If you defer the punishment he will be confused as to its meaning and probably become afruid to perform any natural acts in your presence.

Many playful antics, cuts in a puppy, became had habits in maturity. If you permit a pup to oark (Comment on page 1-2)



New Federal Service to End



IVE million doltars has just been set aside by the S. Government to be used in fighting soil erosion. Under the Public Works Administra-tion, the Department of Interior has orgammed a new bureau, cailed the Soil Erosion Service. At its bead is H. H. Bennett, one of the world's leading outhorities on agricultural erosion. Throughout the nation, it will demonstrate methods of stopping soil washing which, it is es imated, costs American farmers \$400 000 -

Experts of the new service, working in many farming districts, will teach all of the old and new soil-saving methods that prove to be of value when tested under local conditions. But experience gained during his twenty-five years of work as a soil expert in the service of the Department of Agriculture has convinced Bennett that strip cropping, an agricultural

method that has been used by the prosperous Pennsylvania Dutch farmers for many generations, is the most generally useful of anti-crosson methods.

The soil of the Missouri valley is the best corn-growing soil in the world. But each year much of it is washed away Some of it silts up streams and makes the r mivigation slow and expensive. The rest is dissolved, flows with the flood waters into the Mississippi, and eventhat y is carried out to sea. All of it is lost for corn growing,

Soil experts tried an experiment in this region. They picked out two farmers who planted their com on slopes that averaged eight per cent. Of one farmer they asked nothing but permission to install a measuring device. They asked the other farmer to plant his fields in alternating strips of corn and alfalfa

At the end of a year the soil experts' measuring devices told them that the

sloping that its topsoil may be washed away by rains heavy enough to cause water to flow freely over the fields.

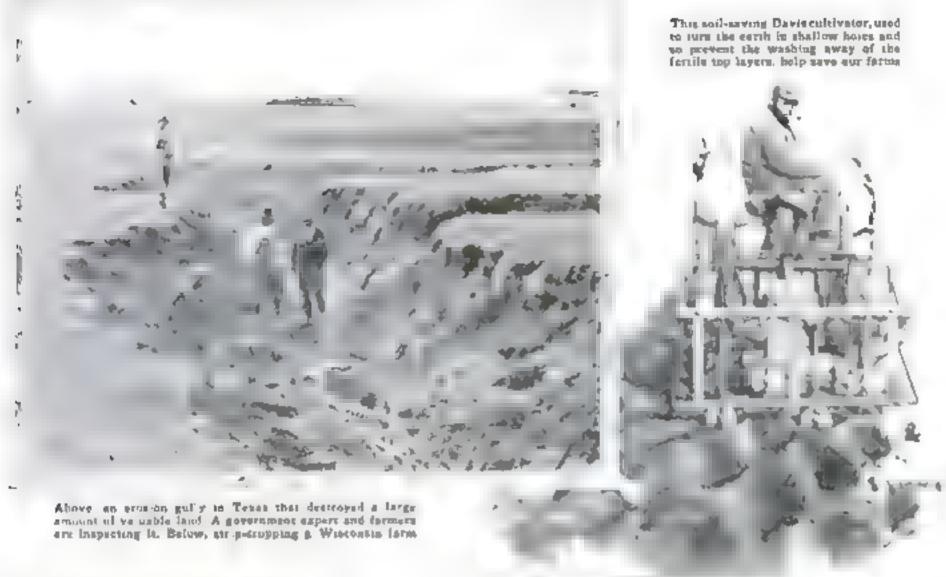
It is estimated that there are in the United States about \$00,000,000 peres of land suitable for cultivation. Aiready our farmers have permitted the destruction of \$5,000,000 acres of good crop land. In the last fifty years more than 100,000 in cultivation have lost all or most of heir topsud. At least 160 000 000 additional acres have been damaged more or less seriously by erosion. Last year 3,-000,000,000 tons of soil were washed out of fields and pastures. Under normal price conditions, this would have caused a loss of \$500 000 000 to the farmers who own the land

Standing on the brank of a 200-foot gulty near he town of Lumpkin in Stewar Cour's sour bwestern Georgia I got a vivid lifea of what soil erosion can do

At first view, this sand-sided gash seemed just another freak of nature But actually it is the result of a farmer's ignorance of effective means of combating soil erosion

Fifty years ago, old-timers told me, that gully was not there. The fertile fields of

Destruction of Our Farms



a prosperous farmer stretched where it now cuts deep into the earth. In one of those fields, over what now is the center of the gully, stood a born.

Naturally, when it rained hard, water ran off the roof of this barn. Then, of course, it ran down hill across the sloping fields. As it went, it took some of the topsoil with it, and soon cut a modest channel for itself

Knowing that it is the nature of water to run down hill, the farmer took no measures to stop it. In a year the little channel became a deep ditch. In another year the ditch grew to a shallow gully Each heavy rain made it deeper and wider Little side gulles began to feed it water and soil in rainy weather. In a few years the gully cut through the topsoil and into the underlying sand.

Each year now it grew much deeper and much wider. One wet day, the barn crashed into it. Still the gully grew. A tenant house followed the barn. A school-house followed the tenant house. Finally, the family graveyard was engulfed. By that time all of the topsoil of the fields had been washed into the hungry gully. The farm had become a harren waste, and the once-prosperous farmer had been forced to make a new start elsewhere.

Many other gulkes, with similar histories, have been at their work in the same district. In less than half a century, 70,000 acres of the best farming land in Stewart County have been destroyed.

In Muskingum County. Once, there is another tragic example of what soil erosion can do—the eighty-acre Redding Farm, once the most fertile in the county. Its owner found corn growing profitable, so he grew corn. Gullies began to cut into his fields, but he went on growing corn. Now there is exactly one acre of the farm on which it is possible to grow anything. The other sevenly-nine acres are an erosion-furrowed waste.

Strip cropping would have saved the farms of Stewart County, Georgia. It would have saved the Redding Farm, and several thousands like it. It would have saved the 90 000 acres of good and that have been destroyed by gudying in a single South Carolina county.

Farm land from which all the topsoil has been washed away is hopelessly lost for probtable crop growing. Of course, even subsoil, if you will work over it hard enough, will grow something. In fact, tens of thousands of our farmers

are subsoil farmers. But it is a losing game—bankrupt farming on bankrupt land.

The work of Soil Erosion Service is not the rehabilitation of fields that have been ruined by soil washing. The efforts of the new service will be concentrated on leaching farmers how to guard the rich linds that so far have escaped and how to stop soil crossop of fields that now are losing their upsoil.

To do thus, large-scale experiments and demonstrations will be made, with the cooperation of local land owners in ten major agricultural districts.

The soil-conservation methods used and taught will vary with the conditions of soil, average slope, and chimate. In the fertile hills of Wisconsin, strip cropping will be used on (Continued on page 98)

\mathcal{A} Portable Kit for your MICROSCOPE

PORTABLE kit that holds your microscope, various bottles, instruments, iduminator, macrotome, specimen boxes, and slides will enable you to take your bobby with you wherever you go. You can use the kit on your desk, workbench, or the kitchen table; and it affords a convenient piace to store your equipment when not in use

Being designed to hold a full-sized microscope and accessories, the kit is somewhat larger than would be necessary if the small microscope seen in the photographs were to be used with it exclusively. Also, the size was determined comewhat by the dimensions of the laboratory table to which it is an accessory

There is nothing difficult about making the outer case because in reality it is a plain our with a remova de door in front It can be made of whatever wood is available. If the parts are carefully squared, the joints well fitted, and glue is used an well an nails and screws, the case will be both alrong and nest. When

a small circular saw is available, however, the case can be made with rabbeted joints as shown in the accompanying illustrations. In the original model, fiveply-maple veneer paneling Bi-in, thick was selected for the outer case, and 1/4-in. thick three-ply veneer for the drawer case. White

pine 1, in thick was used for all parts of the drawers except the unepiec a of the slide along drawer which are from the k If solid wood is used for the outer case,

it should be 3/2-in, thick

The case is Le son long 14-in high. and 9 in deep outside demensions. If h in, thick veneer paneling is used make the end piece 912-10, by 14-in, and cut rabbets watern deep by wear, wide around all four coges of each on the inside surfaces. The toy and bottom will



The bit contains a special drawer in which the silder are placed

be 9½-in, by 17½-in., and should be rab-beted along both of the longer edges, on the inside surfaces. The back and front are 135%-in, by 171/4-in, so as to fit in the rabbets. The edges of the front board should be dressed so that it will slip in easily but snugly; the back, however, should fit reasonably tight. Fasten the ends, top, bottom, and back together with glue and brads or slender round-headed

Four brass box corners are mounted on the lower four corners of he case. Those an front form pockets into which the two lower corners of the front hoard can be supped. The upper edge is held by a haip and stapic with either a book or a padtock, as preferred.

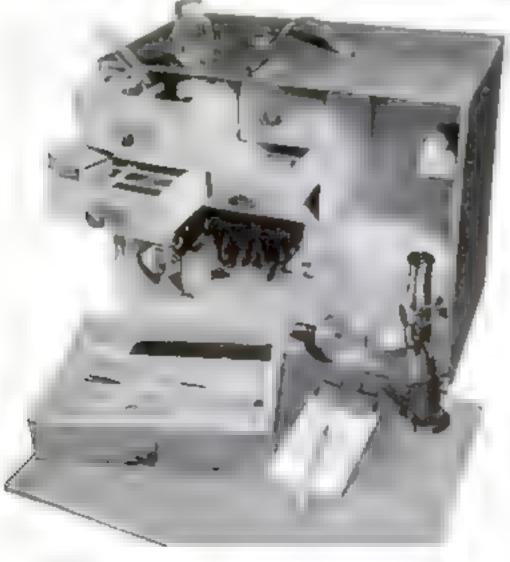
The inner case or the drawers can be made as a separate unit-that is, like a bux with top, buttom, two ends, and the necessary partitions, and inserted after it has been assembled. The author, however built the drawer case right into the

larger case, as shown

The drawers are made to fit the openmes in the drawer case. The fronts, however, are a little larger than those openings because they overbang the edges of the drawer case. None of the drawer fronts, however, projects at the top in the plan given.

Some of the drawers have inside partitions. The upper left-hand drawer for test tubes has three strips running from front to back. The specimen boxes used in another drawer are empty safety-match boxes. At the rear are two compariments for miscellaneous objects. The lower drawer for instruments has three partitions, variously spaced, running across from side to side. In constructing the slide drawer, the slots in the sidepieres can be made easily on a circular saw or in a miter box having some kind of spacing arrangement. The grooves are spaced on

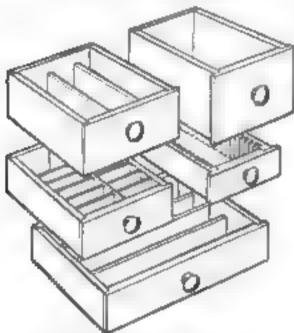
Morton Walling



Here is the portable microscope kit completed and ready for use Note the aurprining amount of equipment that can be carried in it. There are e ips to hold the Nominaior microlome, and microscope and a spring clamp on fruntpiece for a note pad

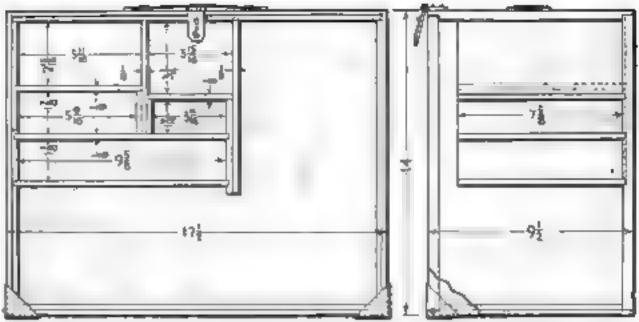
Blueprint Now Ready

To assist you in building the portable kit for your microscope described in the accompanying article, POPULAR SCIENCE MONTHLY has prepared Biseprint No. 220 which will be sent to your address on receipt of 25 cents. See the coupon on page 84.



A Treat for the Amateuri

EVERY amoteur interesting it will be intermenth there will be another article in the farcinating terres on the use of the interments



Above, weeking diagram of microscope kit. At felt, his drawers with partitions in place

J/16-in. centers. The upper right-hand drawer is for suscellaneous supplies and has no partitions. If desired, two additional slide drawers can be substituted for it. In the portion of the case not occupied by the drawers are various clamps and other fittings. The evenience holder, fastened to the side of the box near the microscope, consists of a strip of wood having a row of holes. It is best to construct this holder so that the holes have closed bottoms, and to line them with some soft material such as felt. The exact design of all clamps will depend on the equipment itself

The illuminator illustrated consists of a bell-ringing transformer equipped with a flash ight reflector and a No. 40 6-volt radio dial light. If you are traveling where there is no 110-volt electric supply, you can substitute a dry-cell battery for

the transformer, and use a low-voltage focusing-type flash-light bulb instead of the No. 40

You will find that a spring clamp, similar to those employed on tup boards, mounted on the inside of the front piece near the top and directly in front of the drawers, will be handy for ho ding notes. The front board thus becomes a convenient drawing board

The outside of the kit can be finished in any conventional manner, and the inside surfaces left in their natural state. A set of furniture slides on the bottom of the kit box is an improvement.

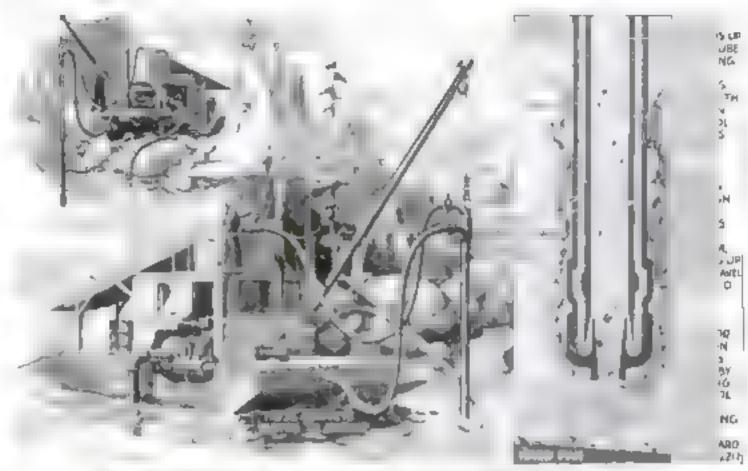
The cost of the kit illustrated including bottles, specimen boxes, and clamp, was about four dollars, more than half of which was for the mapie veneer paneing. This means that the kit can be built for as much or as it leas you wish.



Suction Dredge Mines Gold Beneath Water

A Gour dreage that will here its own way to deposits of the precious metal buried underwater. and then bring the pay dirt to the surface by suction, is the mm of Bert O. Godfrey, Bruoklyn, N. Y., inventor, (I' S.M. Dec '31, p. 37) He has just designed such an apparatus to work on the principle of a drewing-table atomiser Its bus ness end is a suction nozzie at the bottom of a double-walled pape which is lowered from a harge or truck, To bring up gold, water is pumper down to the notale through the outer section of pipe. Curving walls discharge the jet back upward through the central pipe with such force that it travels al. the way to the top Moreover, so powerful a suction is created at an orthica in the hottom of

the nozaic that gold-bearing sand and even solid nuggets, Godfrey says, will be carried along with the atream so that they can be recovered. If the suction orifice becomes clossed by a ruck or other foreign object, it is merely necessary to abut off a discharge valve at the upper end. This reverses the flow of water which is-



It correst on always shows the enables in which the new gold stedge will a it the practice metal from a make beneath the water by means of pressure around in the double we sed pipe

and the discharge valve may then be closed to resume recovery of gold. The same procedure is followed to dig a bole with the device, since the hydraulic jet rapidly eats its way into a soft bottom Quantities of lead shot were raised from the bottom of the harbor of Scattle

Wash, in tests of his device, the inventor reports; and he declares that he also has successfully raised gold nuggets, of which he bought \$200 worth especially for the test, with a twenty-foot laboratory model of his successes pape. These successes suggest that the device will prove of considerable practical value.

DYE TESTS ATHLETE'S CONDITION







An electric heating elemen in a critical of as per marks here to the world a proper

ELECTRIC HEATER THAWS OUT PIPES

Si trabile for thawing a frozen water inner or for keeping the radiator of a car from freezing in a cold gatage, a new electric pape heater consists of a heating element embedded in a flexible collar of this copper. It is readily drawn tight on a pape and fastened as shown above, without the use of tools, while the attached electric cord may be plugged into any outlet. The device immersed in a glass of cold water will, its manufacturer says, quickly bring it to the boiling point

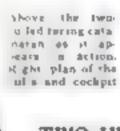


FAMOUS ABBEY GETS MILK BATH

Historic Westminster Abbey, lamed British sanctuary, in which many of England's great men famed in literature, art, and statesmanship, are buried recently received a milk bath. Busy workmen applied gallon after gallon of skimmed milk to its massive arches, palars, and even its statues. The unique treatment recommended by architectural experts, was intended not only to clean the stonework but to aid in preserving it. The results will be watched with core although it is said five years must elapse before the value of the treatment is apparent.

BLOWTORCH FIGHTS FOREST FIRE

By THE odd expedient of fighting fire with blow-torches, forest rangers are limiting the ravages in timber lands. The portable outlit, shown in action below, has been tried out successfully at Carson, Wash, as a means of starting a backfire. Gasoune carried in a tank on the forester's back freds the hand toech, which speedily ignites stumps and brush, while cleared areas check the resulting blaze. With the trees in its path destroyed, the fire is quickly controlled.





New styles in sading craft are set by the racing cutamaran. Amaryllis, latest creation of Nat Herresboll, whose yachts have often victoriously defended the America's Cup. The veteran boot bunder declares his new design offers extraordinary speed in a sailboat, while it makes an upset almost impossible. Its type is virtually without precedent, mainly because its fundamental principles have not bitherto been fully understood. The boat has two pontoon like bulls of thirty-three-foot length, joined by cross members that terminate in hall-and-socket joints, giving the hulls some latitude of movement with respect to each other. A cockpit like that of an iceboat supported between the hulls, accommodates a crew of six. Each hull has a centerboard and rudder, and the two rudders are rigged to swing simultaneously with a single tiller. The sail area totals 900 square feet. Should boats of the new type prove popular, the builder foresees races that will provide new thrills.

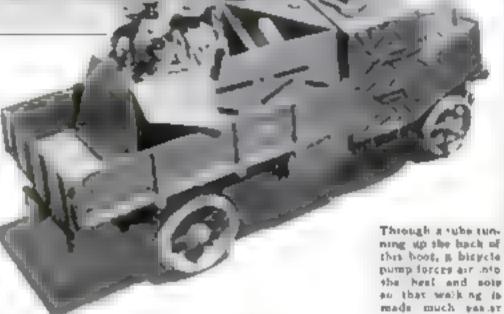


EMERGENCY WAR TANKS MADE OF STANDARD ARMY TRUCKS

By converting ordinary military tracks into war tanks to girl in scattering anti-foreign mohs, U.S. Army regulars scattoned at Tientsin, China, have added to the safety of Americans an that country. With no tanks or armored care immediately available in China, the men obtained two standard trucks and armored them with five-sixteenths-inch steel. Combat turrets, fitted with three machine guns apiece, were added, and a fourth machine gun was mounted in each cab. Loopholes for the guns are concealed by a ramouslage of unitation loopholes.

Above Army truck convorted into war tank by having armor placed on vides and top. It is equipped with four mechine muns that are fired through small loophous

At right view of the war. tank made from an Army truck for use a China In this picture the hone ed top plates are open to lot the so diere enter





NEW PIPE-LINE JOINT PREVENTS LEAKS



LEAKS in high-pressure lines carrying steam, oil, gas, water, or air are said to he prevented by the use of a new type of connection for sections of pipe. Instead of providing a single seat, the new union has two serrated ends one hard and one soft that form four distinct seats. The unions may be attached and disconnected repeatedly without spoiling the seats, providing economy in insintenance. In the photograph at left one of the unions is shown dismantled to reveal the serrated edge, to which the pencil is pointing

PNEUMATIC BOOTS LET WEARER WALK ON AIR

Walking on air becomes a fact with the invention of poeumatic boots recenly exhibited in Englanc. To increase the wearer's comfort the sole and heef are provided with eastie air cushans. These are inflated through tubes that extend upthe back of the boots, as shown in the cutaway model above, using an ordinary bicycle pump.

CIGARETTE PACKAGE IS OPENED BY THIS HOLDER

Serving the dual purpose of opening a pack of rigarettes and holding the pack after it is opened, a handy appliance for smokers has just been placed on the market. When the pack is slid endwise into

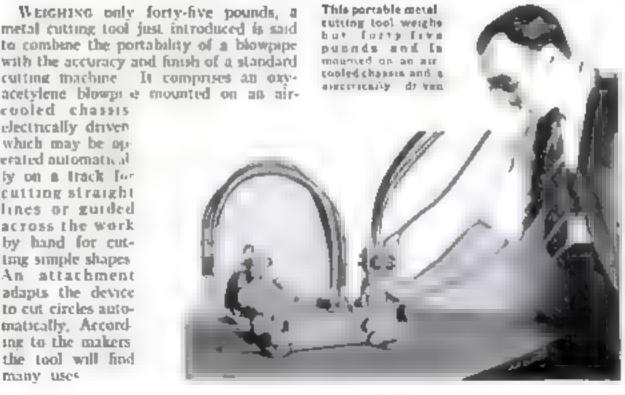
the border, a sharp km fe edge severs a strip of the wrappings on the top When a release but ton is subsequently pressed, a hinged section springs up as illustrated at right, lifting the wrappings and exposing the cigarettes. When closed it affords them adequate protection.



PORTABLE CUTTING TOOL HAS MANY USES

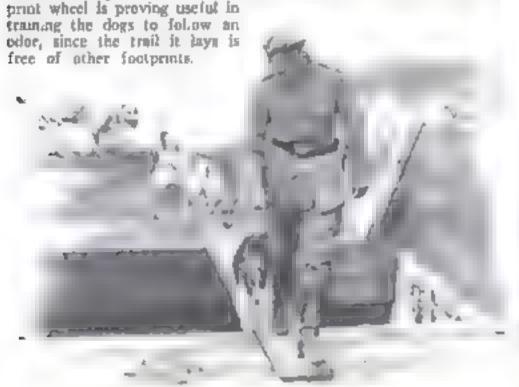
WEIGHING only forty-five pounds, a metal cutting tool just introduced is said to combine the portability of a blowpape with the accuracy and finish of a standard cutting machine. It comprises an oxy-

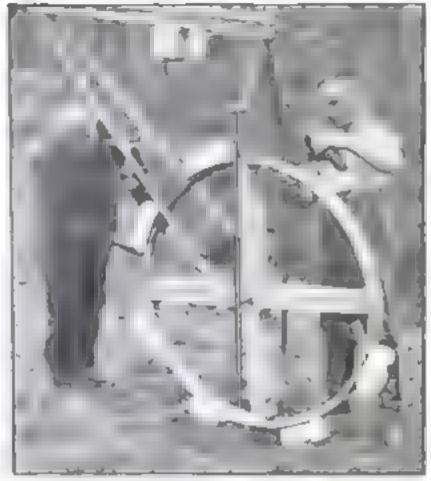
cooled chassis electrically driver which may be ouerated automatical ty on a track for cutting straight lines or guided across the work by hand for cuttang simple shapes An attachment adapts the device to cut circles automatically. According to the makers the tool will find many uses



Put Shoes on Wheel to Train Police Dogs

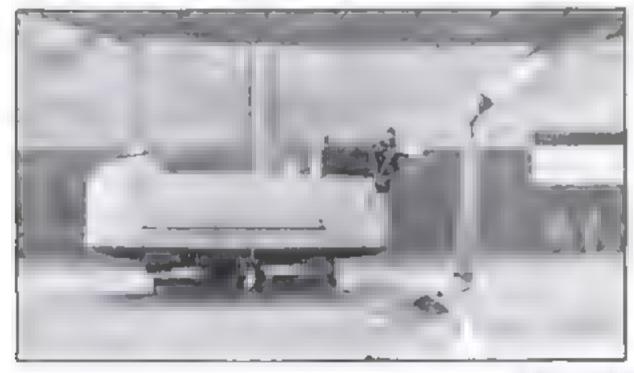
FOOTPRINT wheels, devised by French police officials, have enabled them to prove that a police dog follows a fugitive's trail by scent alone, and not by sight. Models of a shoe were mounted on the rim of the wheel shown at right and it was drawn along the ground, thus leaving realistic-looking footprints. Police dogs were unable to follow this track. They had no difficulty in picking up the scent, however, when a pair of old shoes were placed on the wheel. The foot-

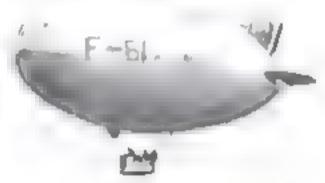




Shoen, attached to this whee make footprints with which the F each are reading makes dogs. At the left, dags are seen on trailed lowing lootprints.

USE MOTOR TO FLY ARMY BALLOON





By morouging an observation balloon, Army Air Curps officers at Scott Field, lil., recently conducted a successful experiment in increasing its mobility. After having flown from a cable in the usual way, the balloon was haused to the ground and the improvised power car shown at left was added. 'Under its own power, as above, it then flow to other observation pants and moored at a distant mast. Hitherto an observation balloon has had to be towed by a ground vehicle.

GIANT CRABS TURNED INTO FERTILIZER

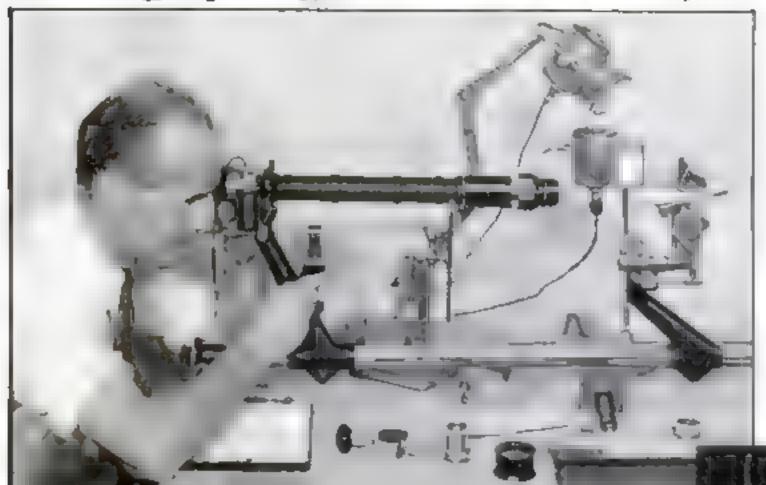
Krvg crabs, a grant form of shell fish, bring new revenue to enterprising fisherman along the eastern coast. Unedible and otherwise useless, these sea creatures are now sold to thousands of farms as a highly improved fertilizer. Dried and pulverized, they contain more than fourteen percent ammonia. The powder, resembling ground coffee, is said to retain its strength twice as long as any common fertilizer. Large pounds or cages arranged in shallow water in the spring of the year trap the crubs. At low tide, the day's catch is transferred from the traps to large open bins to dry. After three months, the shells are ground, bagged, and placed in covered sheds to age





Thousands of King crabs, one of which is about at the left are pixel in this open bin to dry, before being sold for leviding

Photographing Insect Monsters, His Hobby



Telephone Supervisor Designs New Sel-up to Use With His Imy Camera

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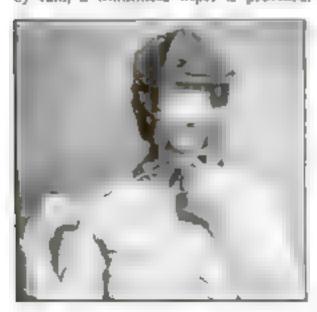
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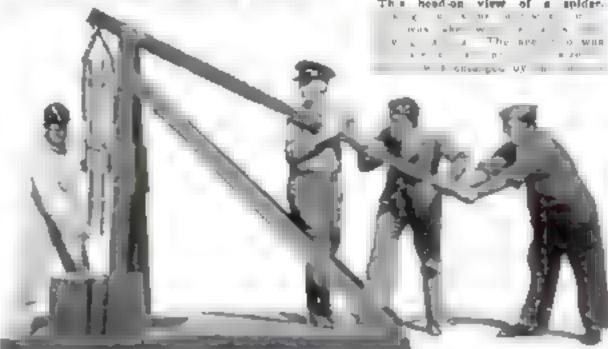
are apparely in the present as the right

The bood-on view of a spider. K C C C THE R T ST E IT a The are to will

WINDSHIELD AND WIPER FOR MOTOR CYCLISTS

For use by motor cyclists in stormy weather, a new belinet goes fat toward providing the comforts of a closed car It comprises a waterproof bood with a built-in windshield, divided in two parts so that the top may be raised or lowered at will. As the window may be obscured by rain, a windshield wiper is provided.

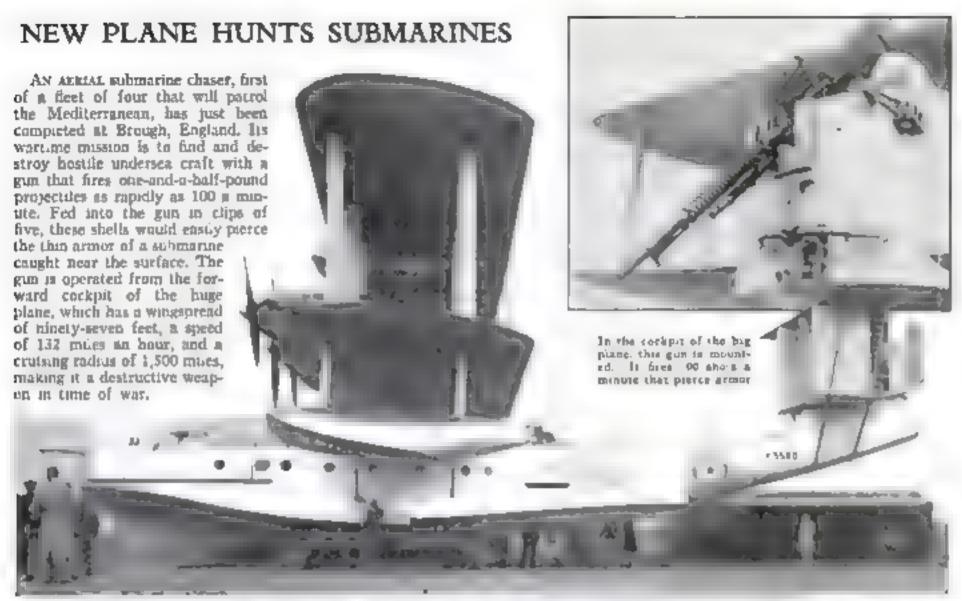




SAFETY BELTS FOR ARMY FLYERS GET RIGID TEST

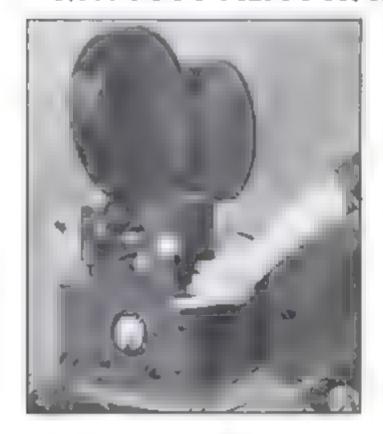
Bedat se modern pursuit (actics place excessive a resses on safety belts, pilots of the 4 5th Pursual Squaoron Reserve at Long Beach Call test their belts at frequent intervals. The safety belt with its hangers is removed from the airplane and placed in the testing machine shown

above. One end is connected to the short end of the lever, and the other to the weights at the bottom. When the long end of the levet is depressed, the safety belt lifts the weights attached to its lower end. The belt must be capable of supporting a load of five hundred pounds.



This huge plane, seventy fret in length and ninety-seven festacture the wings, is designed to chase and destroy submarines

3.000-FOOT FILM FOR RADIO PROGRAM



EROSDEASTING A CONTINUOUS twenty-tour-hour radio program from a record prepared in advance, is made possible, it is said, with apparatus devised by Chiton R Skinner, young San Francisco inventor of motion picture equipment. The record as multe on a 3 300-foot toll of film, no larger in diameter than the standard fifteen-minute trunacraption disk now employed for canned programs. Since the entire film is utilized for sound, as many as twenty sound tracks can be put on each strip, and the reproducer, illustrated at left, will automatically jump to the next sound track when one is peayed through. Thus the apparatus removes the need of changing records every few minutes and suggests the possibility of robot broadcasting stations operating virtually without the intervention of a human hand.

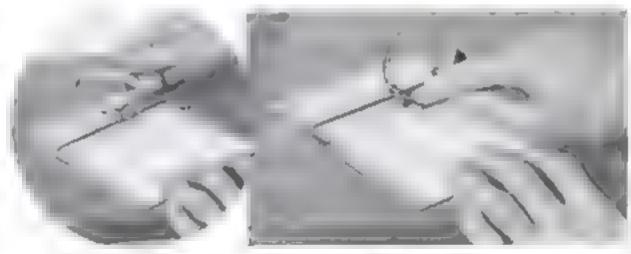


ILLUMINATED SLIPPERS FOR USE AT NIGHT

ILLUMINATED slippers now protect the person who arises in the hight from the danger of stubbing his toe or forling downstairs. A flashlight bulb, mounted at the front of each heel, as shown above, casts a helpful beam ahead each time the wenter takes a step. The lumps operate on current from small dry els in he beels. The slippers are sold already equipped with the light and ha tery. A shield of the bottom and in front guards the bulb so it is not easily broken in case the heel is accidentally struck against something of the shoe dropped.

SIMPLEST TYPEWRITER HAS LETTERS ON A RING

SIMPLEST of all typewriters, an inexpensive new toy for children consists of a metal band on which the letters of the alphabet are emboused. Rotating the ring cause the letters to pass over an ink roller. When the desired character is in position, it is pressed down and makes an impression on the paper. By moving the roller along a guide that is provided it is easy, according to the maker to produce neatly typewritten letters that have the appearance of having come from a standard machine.



In circle, typewriter tipped over to show hole through which letters are printed as seen above



p y by rejecting the appropriate size

HANDY TOASTER Prissng a lever raises the top of the togeter as dustration shows, so it is easy to sweep out the crumbs. Also opening the doors, turns togst over

Sea Tractor to Save Wrecked Ships

Machine Walks on Bottom of Ocean

DESIGNED to aid stranded vessels, and to help in salvaging the cargo of sunken linera a marino emergency tractor of skyscraper dimensions has been designed by a New York Inventor Large enough to stradule a good stred ocean-going ship, the U-shaped frame of the tractor is propeded along a shallow bottom by endless, motor-driven treads. Above the frame, a pontoon deck gives the apparatus enough buoyancy to float in deep water, while other decks provide facalities for rescue and salvage work. Removing the passengers and crew of a vessel that has run aground would he an easy task for this monster machine its inventor maintains.

since it may be maneuvered as independently of musine topingraphy as is any army truck on land. The tractor pilot has simply to bring his vehicle in position over the ship as shown by our artist on this month's cover, and

ANDCARLO HIRE BAR IS A 10 II MARC PERMINA PASS DYER HOLES IN BOT ON

Il unitation shows see tractor on it would be used in anivaging a wrecked ship that had such in shallow water

the survivors are hoisted aboard with derrick-powered elevators. If the ship is in imminent danger of breaking up, a cofferdam of piling a said by the rescue machine on the woodward side

of its maneuverability on the sea bottom, gram on this page.

EXHIBIT TELLS STORY OF ARTIFICIAL LIGHT

Walter Hough, of the Smithsonian Institution. Starting with the light of the first fire, made by rubbing sticks, his collection recalls such odd facts as that Shetland Islanders, within the memory of living in-

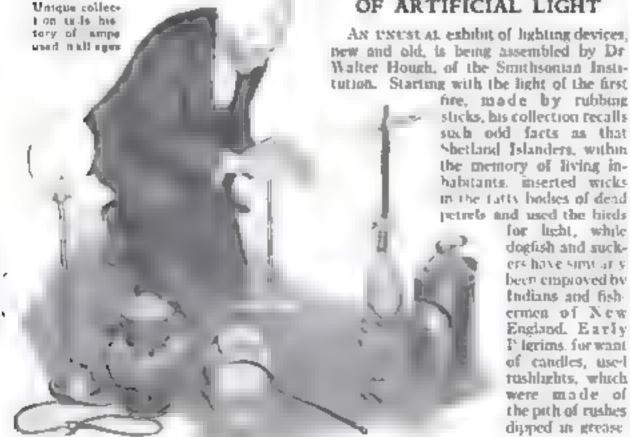
> for light, while doglish and suckers have similarly been emproved by Indians and fishermen of New England, Early I' lgrims, for want of candles, used tushlights, which were made of the pith of rushes disped in grease

the tractor would also be an effective base for solvage operations on sunken wrecks, as is clearly shown in the dia-

INK VISIBLE IN THIS PEN

A FOUNTAIN pen recentry placed on the market will never annoy its owner by unexpectedly running dry. The barrel is transparent, and the evel of the ink within it is plainly visible at all times, reminding the user in advance when it needs refilling. A decorative striped finish on the exterior of the pen is

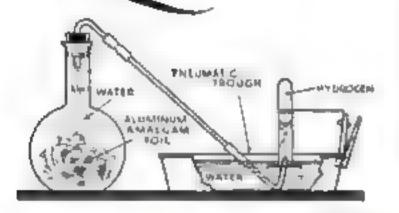
applied in such a way that it does not interfere with the view of the barrel's contents, as shown in the accompanying photograph. The pen is filled in the ordinary manner by working a suction plunger. Frequent filangs, it is said, do not discolor the barrel of the pen so as to render the contents invising



Unusual stunts you can do with

Freakish







ERCLRY, a liquid at ordinary temperatures, is the strangest of all metals and hence offers the home chemist many interesting and enlightening experiments.

Examine a bit of the bright, silvery substance. You will find that it has a strong tendency to scatter us to tiny drop-lets. From this property, the metal obtained its cummon name of "quicksilver"

Considered on the basis of volume mercury is on expensive metal. For twenty-five cents you will obtain only a small viaiful. In weight, however, it is quite reasonable, for few metals weigh more for a given volume.

You can demonstrate this by dropping various metal articles into a pool of mercury. Iton, steel, tin, brass, copper and and will bob around on its surface like corks in a pool of water. Gold, on the other hand, being heavier than mercury, will sink in the strange liquid.

Aforminum (oil), which has been treated with a bichloride of markury solution, in mineral n n flash of water. The aluminum tembrates with the oxygen in the water and frees the byd ogen which is collected in the test tube. At left, digram showing attengement of apparatus needed to make this appearment.

Before dropping one of your best gold temkets into the mercury however that must protect it by coating it with a thick layer of cold cream or heavy oil. If this is not done, the mercury will alloy with the gold to form a tenacious coating that will be difficult to remove

In fact, mercury will alloy in this way with many metals. The chemist calls the coating an amalgam and the mercury is said to amalgamate the metal. It is this queer property that has made mercury a canal is ind in good on time Impute gold, ore, and gravels mixed with mercury immediately form a gold amalgam. When this is beated, the mercury distills off leaving the pure gold bebind. Similar dissolving processes of amalgamations

are possible ordinarily with every metal but from, and under special conditions even from succumbs to mercury's action.

In the amateumation of mercusy with aduntuum, the home chemist will find a spectacular experiment. Spread out a small sheet of ordinary aluminum fuil of the type used to wrap candy bars or photographic firms on your laboratory bench. Then using a stick or a small brush, paint a surface of the foil with a saturated solution of mercuric chloride (bichloride of mercury, not the dilute solution sold as a germicide). Make letters or inagnias or cover the foil completely with the liquid. This will coat the aluminum with

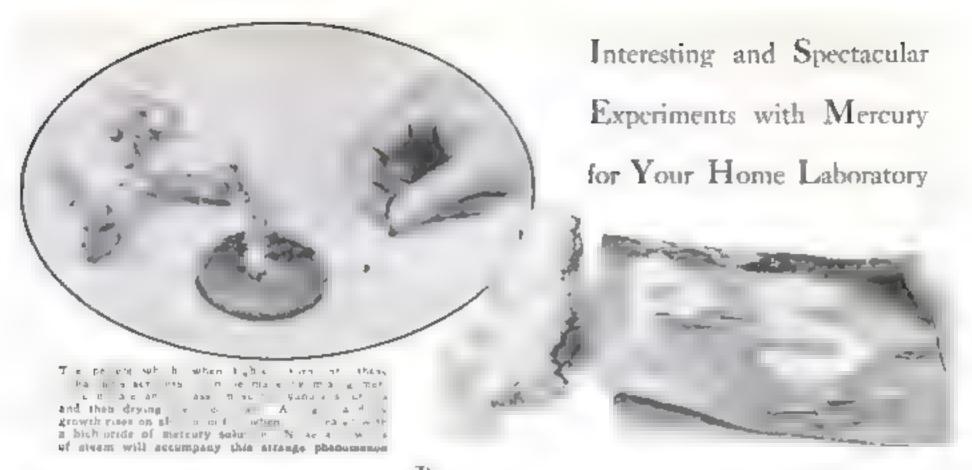
frosted appearance. A white fluffy growth will form on the treated surface, crinkly noises will be heard, and wisps of steam will rise from the substance. In time the fluffy fur will become at least a quarter of an inch thick. When left over right, the fur often becomes coated with a wisp-like web that enhances the strange effect Chemically speaking, this mysterious crowth is aluminum oxide.

As a word of caution, the amateur must bear in mind that bichloride of mercury is a deadly poison. However, it can be used safely and sanely if the experimenter will handle it carefully and take care to keep it away from his mouth. To be on the safe side, wash your hands repeatedly when using it.

As a second experiment along the same time roll a sheet of the auminum foil into a loose hundle and, supporting it on a wire, lower it into the concentrated bichloride of mercury solution. The mass

Weighing Chemicals with Money

> Therefore, Two Half Dollars and a Dime Combined Serve as a One-Onnce Weight



of amalgam formed when the growth starts will be so great that counderable heat will be generated

Aluminum foil treated in this way will perform an equal y starting feat by liberating hydrogen from ordinary water. The oxygen in the water unites with the aluminum to form aluminum oxide and the

hydrogen gas is set free

To produce a slow but steady attento of hydrogen by this process, stuff a large wad of untreated alaminum for into a bottle or a chemical flask. Pour some of the saturated bichloride solution into the bottle and shake it well to make sure that the solution reaches all parts of the foil. Then pour off the mercury solution and fil the flask with water.

range the apparatus as shown in the photograph. Insert a cork fitted with a delivery tube into the neck of the flask, invert a test tube of water over the shelf of the collecting trough recently described (P. S. M., June '33, p. 48) and, after waiting for the first few hubbles of the gas to clear the system of air, place the end of the desivery tube under the inverted mouth of the water-filled tube.

When the test tube is completely filled with the gas, place your thumb over its mouth, and remove it from the trough. Then removing your thumb, quickly brang a lighted match or splinter up to the opener, end. The harmless purping explosion that results will be a fairly good sign that the tube contained hydrogen

For the next experiment, you will need enough mercury to form a small pool or flattened drop. Carefully pour a little delute sulphuric acid on it and then add a drop of potassium-permanganate solution. Your drop of mercury will take on a faint purple color

Touch one edge of the drop with the tip of an iron wire or needle. To your surprise, the drop will shrink or "ball up." As it pulls away from the iron, it will flatten out only to come in contact with the wire again and immediately contract into a ball. This rhythmic motion will continue for some time

If a potassium-dichromate solution is

By Raymond B. Wailes

used in place of the potassium permanganate, streamy clouds of precipitate will be found as the mercury pulls away from the iron

After using the mercury for several of these experiments, it is best to shake it vigorously with weak nitric acid (a five per cent solution) to free it of some of its impurities. The natric acid can be removed easily by shaking the mercury with water,

Another experiment of a similar nature can be performed by covering the mercury drop with a solution of ordinary table salt and placing a trystal of copper sulphate on top of the drop. When this is touched with an iron wire, the crystal will immediately jump toward the wire

and then skip over the surface of the mercury leaving it extremely bright. After a time, when the mercury contains too much copper, the motion will cease.

Ity mixing solutions of mercuric chloride and ammonium oxalite, the amateur chemist can make a light-sensitive liquid that can be used as the basis for any number of interesting light experiments. Kept in the dack, the solution will remain colorless, resembling ordinary water, A short exposure to light, however, will cause it immediately to cloud up; a white precipitate being formed. Even a had hour's exposure to a lighted, low-wattage lamp will cause a marked whitening.

So sensitive is this solution to light, that it can be used to measure accurately the relative intensities of different light sources. By martysing the solutions before and after the exposures, a numerical gage of the light intensity can be ob-

tained

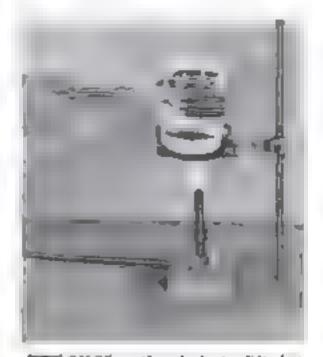
With a few chemicals, the experimenter can compound a peculiar substance that on burning produces large quantities of fluffy ash. Moided into peliets, this substance is sold on the fourth of July as "snakes in the grass."

To make your own pellets, prepare a solution of mercuric nitrate by dissolving the chemical in warm water. Also, make a similar solution of potassium sulphocyanate. Add several drops of fron-chloride solution to the mercuric nitrate and then add some of the potassium-sulphocyanate solution. As the white precipitate forms, stir it well and then allow it to settle

Continue adding the potassium-sulphocyanate solution in small quantities until the entire mixture turns red or parkish. This sign, furnished by the iron chloride in the mixture, is a visual indication that the reaction has been completed. If the red color slowly fades, add more potassium sulphocyanate

The precipitate formed then should be washed by decantation (P. S. M., Nov '33, p. 54), spread out on a sheet of glass to dry, and molded into small puls or pellets by ramming it into a round tube. To agaite one of the pills, place it on the tin top of a mayonnaise jar or can and bring a lighted match to its upper end.

HANDY TONGS



TONGS with which to lift bot beakers, are easily made out of an ordinary potato lifter. The prongs of the fork are covered with rubber tubing to prevent them from slipping when beaker is grasped

Home Tests of Scientific Facts

Eurprisingly sittle apparatus is needed to perform a number of nteresting experiments, Luistrat og natural aws. For insenner at the eight a tube of seun flores has been megnetsted by drawing a magnet over company meedle, Shaking the tube chause the magnetism to wan all because the iron particlos in the rube are thrown out of a agreement and no longer behava an a ningia argu magnes.



Merals expend when heated, but they do not all expand to the same amount. At left, you eer what bappens when a strip of from in rivered to a strip of brave and then brated The dil ference in expansion of the two metals, bands strip into an Acc.



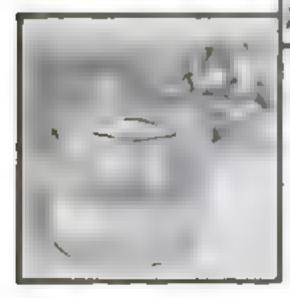
To make this embro dery boop roll up hill attack a turn or two of we can der to be loowed edge of the rim. This throws the boop's center of gray ty above and ahead of the point of support. The boop was tol up had as it tends to lower the actual center of gray ty

At right is a simple to m of water turbino made of a cardbon d tube corked in his buttem Two hors are punched a an wise near the bottom 41 shown below. When the tube a filled with water and auspended by a billing, it will, er ed) or sub swiover cost from the jate of water spuring out acdowards trum the buits This demonas area the law that for every action there or an appearing and equal reaction present.





The tendency of the film of a squadto contract to the small set googable aren a called corlace tennion. To trut then, let a drop of or fail into de a lubberhandfloating on water. They excerrubber band into meatly a partect circui-



Above an experiment to prove that a prohole in a card acts I ke a fens. Light rays from any point on the electric bulb, passing through the pushale, can fall only an one spot ad the screen As a ceso r a perfect inverted image of the blament can be seen clearly outlined on the across

Coul gas is formed when coal is heared with insufficient air for com-bustion. Similarly, "paper gas" can be made by for ng a newspaper as shown at right and right of the ower and Gas issuing from the upper end of roll, burns when lighted



FINDING THE SOURCE OF

Mysterious Radio Troubles



Ratelos in a radio may often be traced to the vehicle one caused in Pages and other things that are tenting man the lowespeaker cabines

ECENTLY a radio repair man answered a call from one of his customers. The radio, he was told had suddenly developed the mysterious habit of shutting off the moment a near-by chair was used.

Doubting the story, the service man flicked the switch on the side of the cabinet and tuned the set to the loudest sta-100 The outfit performed beautifully Strucing over to the mystic chair, he sank and an comfortable cushions. Immediately, as if it enced by some ghostly hand,

the radio stopped.

In the search that followed, the repair man discovered a peculiar thing. A loose hoard in the floor supported one foot of the chair or well as one of the legs of he radio cabinet. The singhtest added weight in the chair lifted the opposite end of the floor board, musing one corner of the rodio cabinet, and twisting the receiver chassis.

Continuous twisting had broken a solthered connection aiside the set. After that, the slightest movement of the chassis puzzed the wires apart and opened the cir-

This is only one example of the many strange, almost inexplainable things that can happen to a radio. Not all frombles can be traced to cut and dried causes such as poor tubes or faulty parts. In fact, it is the out of the way trouble that is the easiest to fix but the hardest to locate.

Many times the real seat of the trouble is for removed from the set itself. For example, every rattle and rasp that assues from a loudspeaker as not due necessarily to



 $\mathcal{B}_{\mathcal{Y}}$ George H. Waltz

some defect in the cone or unit. In many cases, especially on the lower notes, troublesome rumbrings can be traced to vibrating ornaments and other bric-a-brac that adorn the calanet top or near-by tables If your speaker rattles, always make a tew tests by remov-

ing any objects that may vibrate

If you are sure the tattle is not from some outside source and the speaker diaphragm appears tight, inspect the cone near its center Often a slight buckling will cause speaker boises that are hard to trace to their source.

Even chassis parts can be the cause of many speaker noises, Loose-fitting coil and tube shields in particular have been

found to cause many types of crashings and sputterings that mar reception. To make sure that your shields fit tightly, bend the tim of each base sleghtly out of round to insure

good contact and prevent vibrations

Loud crashes and scratchings blasting from your loudspeaker when you turn the turning dial may mean nothing more than

bent or dirty wiper arms on the condenser rotor. To provide a good contact and end the trouble once and for all, solder a flexible pigtail connection across the wiper arm and rotor

A noisy volume control is not always a sign that the part must be replaced. The noise may be caused by nothing more mysterious than a piece of dirt that has worked its way between the resistance and the contact arm. Twisting the control back and forth over its full swing generally will free the dirt and stop

Every now and then a new radio ailment comes to light. Not so long ago, the writer heard of one that had stumped the owner of the set

for some time. When first switched on, the receiver operated as 1, should, After five or ten minutes, however, it would go into violent osculation. Weird bowls and squeals would blot out the program.

Suspecting the tubes, the owner took them to an expert service man. Much to his surprise, tests showed them to be in perfect condition and a careful inspection of the set failed to reveal any visible de-

fect in the actual circuit.

When a radio acts as this one did, the trouble generally can be traced to the expansion of some part due to heat. A resistor or even the tiny elements in a tube after beating up may expand just enough to cause a short circuit or an open connection. Even premature tube failure, it has been found, can be caused by an expanding bias resistor that shortcircuits on the metal receiver chassis.

Tubes may check perfeetly when cold and still fail to give results when they heat up in petual use. For this reason, it is best to test tubes only after they have been allowed to heat up in the receiver circuit.



Although queer loudspeaker noises always mean trouble, it does not necessarily follow that the trouble is made the set. l'oor grounds, for instance, cause many notices that are blamed on a loose connection in the circuit. If you use a radiator for a ground and find that the loudspeaker chatters and sputters everytime you walk across the floor, inspect the piping. Jar the radiator to make it vibrate Nine times out of ten, you will find that you can make the noise appear and disappear at will

Ground poises of this type can be traced to some piece of metal that makes a rubbing contact with the radiator pipe The most frequent offender is the metal lathing in the ceiling of the room below. If the papeng touches it at any point, and vibrations cause the radiator to sway enough to make and break the contact,

hoises are bound to result



The buckling line almost imperceptible pointed out above, may cause a rattle in your loudspeaker



Alternating current hum is another noise that often has its source in the ground circuit. To prevent it, trace through your ground, If it terminates to pipug, find out what other

electrical circuits are grounded to it

As with the mose floor board, most mysterious atments can be traced to some simple cause outside the receiver. Not long ago, an excited customer rushed into a radio service station and explained that his radio refused to work. Although it had been working perfectly only the night before, even the usual noises were lacking when he switched it on again twelve hours later.

After several tests, the service man inspected the power plug—one port that he knew was an old offender where mysterious troubles were concerned. In this case however, it proved to be in perfect order and it was not until a bridge lamp, plugged into the wall receptable, failed to light that the real trouble was discovered. In some way, the bouse fuse supplying the circuit had been blown.

Recently another radio enthusiast complained that his set had developed a steady grinding and scratching. Being an experimenter, he tried several tests. Disconnecting the antenna, he found that the noise stopped.

Offhand, following the general rules, this would tend to indicate that the noise



When inspecting your set, comember that loose shalds can cause trouble

wan man-made static from some near-by piece of electrical machinery

This porticular mystery was not cleared up until a thorough inspection was made Again, the set was not at fault A careful search showed the cause to be a poorly soldered joint at the connection between the lead in wire and the antenna. Corrosion had crept into the loose joint and the wind, swaying the wire to and fro, had caused the scraping contact to set up a fine irritation of violent static

In few cases where the trouble can be classed as "mysterious" it is necessary to rip the circuit apart to find the source. The amateur who services his own set can avoid unnecessary trouble and expense if he will go about his work with an open mind. Hunt out the obvious things first and suppress the desire to pull your set apart at the first sign of trouble.

NEW METHODS MAKE

Remote Control
Popular



ALTHOUGH the

trom a distant point is not new, recent developments have revived interest in remote control

Early attempts at long-distance tuning consisted of a series of push-button switches that operated reversible electric motors geared to the shafts of the receiver controls, Now, visual-tuning meters, kilocycle meters, and thermostatic-oscillator control have been added to bring remote control up to date

With the modern remote-control panes shown in the photographs every function of a radio can be operated overely by pressing buttons and watching the dials of electric meters

In one, a visual tuning meter supprements the usual array of the one. With it, stations can be tuned quickly and accurately. Besides eight buttons that being in preselected stations, two additional buttons allow the set to be tuned to any station on the air while the tuning meter indicates, by the swing of its needle, the exact point at



In this remote-control unit the partiable case houses the turing partial of the set

At righ remote contini panel with a viual taning me or that supplement ha but rand Below a hilotry wheret has shown the frequency tuned



which the station is tuned to hest ad-

A follocycle meter, that shows the exact frequency tuned in, as well as a visual-tuning meter, are featured on the remote-control panel shown directly above. With them, the receiver not only can be tuned accurately bustations can be located easily.

In one remote control system, the selector case itself contains the tuning portion of the radio circuit. Turning the dial just as you would the knob at the receiver, tunes the set. The amplitying portion of the receiver and the speaker are housed in the main cabinet which can be placed where desired. In this particular system, tuning switches and motors are climinated.

Besides the usual controls, this particular panel also provides for tone control, allowing the pitch of the reproduction to be varied to suit the acoustical characteristics of any position in the room

Short Cuts for Radio Builders



AN ADJUSTABLE template that will make it easier for you to transfer screw-hole locations for condensers and similar parts to a panel or chassis can be made from scrape of aluminum absolding As shown in the photograph and drawings, the template consists of three or more pointed aluminum arms fastened together with a short bolt and nut. Cut the strips about one-half inch wide and seven inches long. The siot, running the full length of each arm, should be wide enough to be an

casy many fit for the fastening bolt If a wing nut is used in place of an ordinary nut, the template can be adjusted easily by hand. To use the template, loosen the holding bolt and arrange the arms in their pointed ends rest on the approximate centers of the screw-boles in the part to be mounted. Then, when the template arms are locked in place by tightening the bolt the center marks can be transferred by scribing around the points with a sharpened nail or a regular scriber.—W. P

Homemade Cement for Use on Loudspeaker



A mixture consequence of he I became out and held colleding market telegraphic for local market reports

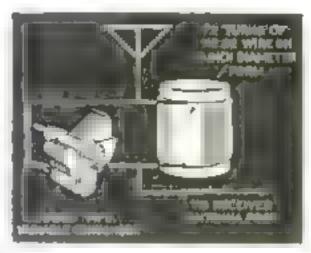
WHEN making reports on a logisticaler, the radio experimenter often is at a loss to know what type of cement is best stated for the work. A handy solution that is quick-drying, fairly elastic, and strong can be made easily by mining equal quanties of collodion and bonana wit. It is equally useful as a cement for fastening loose wires in place and as a ceating for home-wound colls. In an emergency liquid-nail polish also can be used but its cost is almost prolithitive when large quantities are needed When storing any cellulosebase tement of this type, be sure to keep it air tight —B W

Using Your Tone Control

MANY radio owners do not use their tone control to best advantage, Although it is intended primarily for accentuating either the high or low frequencies as desired, it has many other equally important functions. The next time you are

troubled with static, either man-made or natural, try adjusting your tone control in nine cases out of ten, one particular setting will improve though. It is also useful as a quality balance when the set is tuned for low volume. Adjusting it to bring in the higher frequencies, generally will make up for any loss in quality. Don't set the control knob and leave it there. Try various adjustments for each pengram as you time it in.—L. J. G.

Practical Suggestions
for the Amateur Made by
Experienced Workers



Simple Wave Trap Ends Interference

O NE of the best ways to overcome in-terference from a near-by station that persists in apolling reception over a large portion of the dial is to equip your set with a wave trap. One that is inexpensive and yet highly effective can be made from scrap wire and a spare condenser. It consusts of a parallel-connected coil and condenser inserted in the antenna lead of the set. The coil, consisting of seventy-two turns of number twenty-two insulated ware, should be wound on a three-inch diameter form. The condenser should have a capacity of .00025 mfd. If a larger condenier is the only one available, decrease the number of turns on the coil. By trial and error, you can find just the right coil for any condenser With the wave trap in place, tune the set to the best setting for the station you desire and then adjust the wave-trap condenser to eliminate the unwanted station. If the undestrable station is very close to the receiver it may be necessary to shield the wave trap with a regular metal shielding can.-C. H S.

Stripping Insulation

BY CUTTING two shallow grooves in the jawa of your cutting pleas, you can use them for strapping the covering from insulated wire. Using a file of a sharp edged oilstone, form a V-shaped notch at the same point in each at the cutting edges. Make the grooves just deep enough to take the diameter of the wire. To skin the wire, place the end in the notch, close the pliers, and pull. If you have a pair of long-nosed cutting pliers, you can provide the jaws with grooves of various depths to take care of several sizes of wire. When the notches are placed at the inner ends of the cutting jaws near the joint, they do not spoil the places for ordinary cutting operations.-H. W. E.



Why Wouldn't This Car Run!

ONFOUND it, now what?" Fred Steening grumbled as he pushed the gear lever into second. "First time I we ever had to shift on this hill "

John Crae, who was sharing the front scat with him, leaned forward to get his rar nearer the dashboard, "Mutar sounds sweet enough," he observed. "Maybe you gave it too much gas."

'Nope, it wasn't that" Steffins informed him. "I've noticed it several times this morning. You'd feel it if you were driving. The motor's sluggish, won t

take the gas and hasn't any power. Think I'll stop and have a look."

Ten minutes later he banged down the hand and faced his companion dejectedly, "It's got me," he confessed. "I've been

over her from stem to stem and I can t find what's wrong. The wiring seems O, K. and so are the breaker points."

Oh it's probably a little water in the gas," said John carelessly "What's the difference so long as it rows? Let's get going and it may clear itself up "

But things got warse instead of better Every mile or so, something seemed to happen fraide the motor that made it lose more and more power. Even gradual halfs began to prove too much for high gear

Finally, as Fred shifted into low to coax the car over a slight grade just ou side of town, the motor drew its final gasp and refused to start again.

"I knew it was coming " Fred wined Now what are we go us o co

"Call the Mode trarage of course said John. "You stay here and I'll find a phone '

A short time later Gus W Ison, veteran mechanic and half owner of the Mode Garage arrived in his service car

The two men related the peculiar happenings of the last hour

MARTIN BUNN

"Now let me get this straight," Gossaid when they had finished. First of all, when you started out, everything seemed to be O. K. Then all of a sucklen you noticed that the motor didn't have its usual pep. It gut worse and worse unnishe wouldn't climb hills and finally stopped altogether. Is that right?"

S TEFFINS modded, "And the motor sounded all right," he added,

"Good. Then we can start from there." Gus walked to the rear of the car, unscrewed the gas tank cap, and peered down the hole, "Pienty of gas. It can't be that" be reported.

And the gas line isn't cloqued either," put in Crae. "We thecked up on that."

Well, gas isn't our problem, then." agreed Gus. "Have you got the motor grank handy?"

"How shout the ignition." Steffins asted as he handed Gus the crank. "Do YOU Walth I one

Gus shook his head and began turning the meant over some on hand. "That's turnly he sail that's The compresson's not so good. Does the motor use

residence of the

Don't put in a quart from one oil change to the next " said Steffins. "She's not a beavy oil pumper if that's what you mean. Take a look at the plugs. You'll se hey re pretty clean."

"Well something's cut down the compression. But then, I never knew a motor to go dead just because the compression was a little weak," said Gus

Like a doctor examining a patient the veteran mechanic went over the motor piece by piece. The matten, witang, distributor, exchargeor, breaker points, condenser, and the spark plags all proved to be in perfect priles. To Stelling and Crae, finding what had caused the motor suddenly to lose power and stop seemed like an endess trail of tests

'One more thing and we'll have the answer " announced Gus at last I want somebody to hold his foot on the starter leation while I put my car next to the

carburetor "

Steffins lost no time climbing into the driver's seat. When Gus signalled, he stepped on the starter. As the motor span, a hissing none, like encoping a r came from the carburctur

"There! Did you hear that?" cried Gus, turning to Crae

Crae norded and moved closer to the motor block. "Prain as day," he agreed. You know, come to think of it, I heard that this morning but didn't pay any attention to 1. What does it mean?"

That's the leading symptom," Gus chuckled triumphantly "When a motor suddenly loses power and stops and the carburetor makes that hissing noise it can

mean only one thing--"

What ailed Steffin's car? Pot on your thinking cap and get in line for a prize. POPULAR SCIENCE MONTHLY is going to pay twenty-five dollars (\$25) for the best etter from a reader describing the troubic

and telling bow to remedy i

Was the fault in the battery? The valves? The pistons? Or was it something else? Get busy right away and mail your entry to Gus Wisson, Publish YEN R MONTHLY, 381 Fourth Avenue New York N Y, before January 31 1234 when the contest closes.

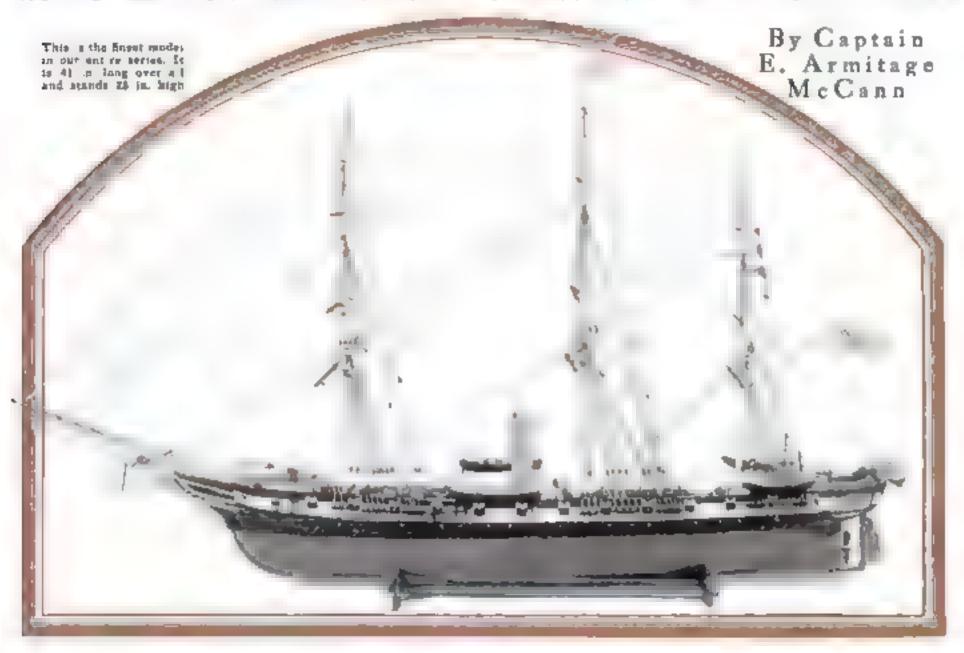
Of course, all employees of Popular SCIENCE MONTHLY and their fam hes are excluded from this contest and in the case of a tie, each tying contestant will be

awarded the full prite.

BETTER SHOP METHODS IDEAS AND PROJECTS FOR THE HANDY MAN



MODEL MAKING: HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME



The model you've been waiting for ...

FARRAGUT'S HARTFORD

Most Famous of Steam-and-Sail Warships

OR years readers have been requesting a model of the United States sloop-of-war Hartford, With the exception of "Old Ironsides," she is the best known of our battleships. She was Admiral David G. Farragut's flagship during the Civil War and was victorious in several hard-fought actions against Confederate ships and forts. Since then she has served on home and foreign stations and as a training ship, and is now at Charleston, S. C., as a station

ship. Her place in naval history is secure

Equally important from the ship model maker's point of view is that she is a famous example of a distinct type. The Hartford belongs to that short period in history when steam served as an auxiliary to sail. This model therefore helps to round out the series of ship models we have been describing in Popular Science Monthly.

The Hartford was launched in 1858 and commissioned the following year. Since

then she has undergone many attentions. An extra deck and navigation bridge were odded, and at one time she had two funcels. Our endeavor, however, is to make her as she was at the height of her fame when she fought under Admiral Farragut during the Civil War.

Built at a cost of \$502,650.16, she had 2,700 tons displacement and 1,900 tons burden. Her length is 225 ft. between perpendiculars (marked PP on the plans) and 310 ft. over all; her beam 44 ft., her



epth 35 (She was at the outset a fulrigged ship and wis when but A d recond-rat a ler hat is constructed of wood

She was originally fitted with a reacting, two-cyl a er let condensing en eme of 34-in score driving a single twopladed propeller. Her maximum speed atuler ste

At first she had sixt in 9-an, shed guns but during the Civil War this was increased to twenty twenty-two, and twenty-four, with two sided swivel guns at ! two aght hownzer. Her narmal war service crew was threty-lour officers and 230 men

I - i w have made other models in this series will be a used with this one the has been the carefully worked our in detail than a model we have yet at tempted. She has all the important features of steam, sail, and tattle-hip The tesult of care only done is a remark Liv beautiful model of genuing historic enterest and great value

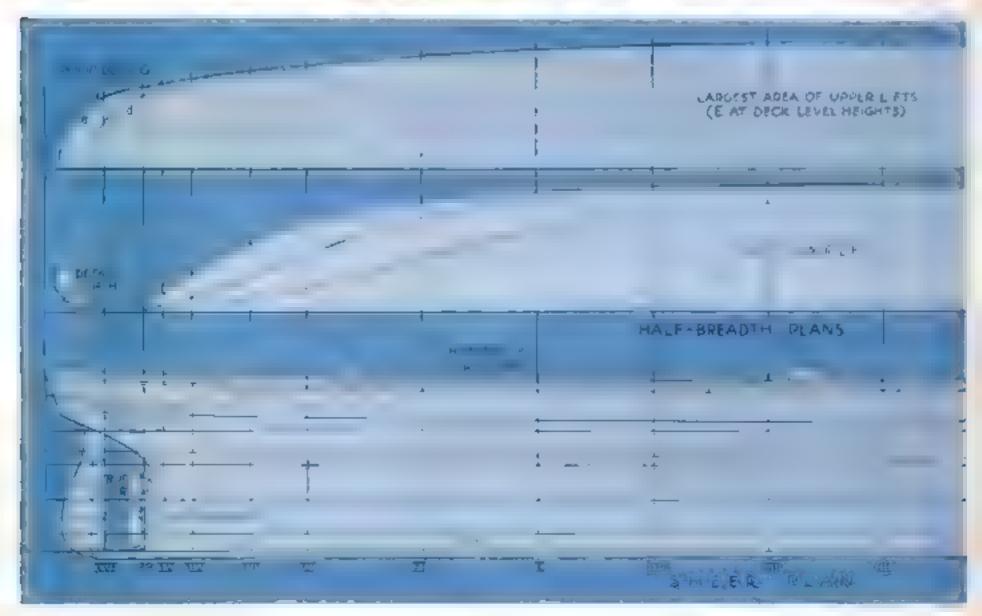
Al hough she requires 4 lot of carefuthe of the same of and the second second second 1 . . . 1 I ft of the rea

1,31

size drawings or bluetimits of all parts, The complete plans wal be given in the agine, although, of course, on a eatay reduced scale because of space nitotions. The mode, is actually 41 in ong over all and 25 an. high, and the ht I some is 33 2 m. long

To make the had, get four pieces of cicar, straight-grained white pane, 332 by I in and dressed to be in thick. On ich from the half-breadth plan, mark he center line and construction lines 1 a XVI, then from the same plans mark the lines b, c, d, s-one on each piece On another piece of pine only 38 in thick mark the line at how out each one in these lines, leaving pier y of mock hi sood the lines for shaving and sanding Fring the cots run inn mes and he cener lines over the edges with the aid of a

Note that the g b, c lives are wateres, that is, their top





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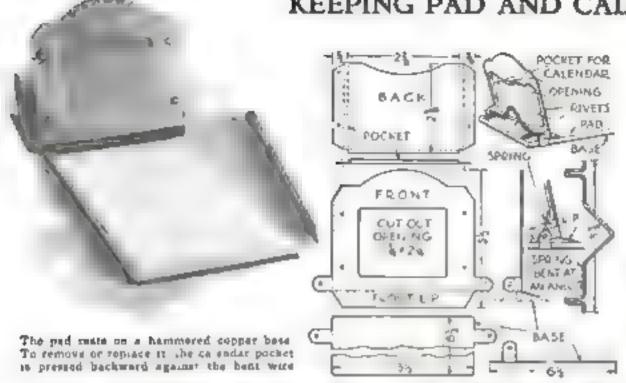
AND THE H W. C. STANN A

P. AN. F. B. AYING CUT T. F. HULL These draw go alms to say a sa for w digital to freto more o ge The pare to he hed an about Toury bat fills do not PROPERTY NUCF F A 8 C AF AL HAR M OF K CAP RAIN RA L TIME IN 3004 51DE5 STATE OF S OJ CA EG. 5 DE Mi 豇 В I

PLAN

RODY

KEEPING PAD AND CALENDAR TOGETHER



To make the combination memo pad and calcular this rated above that lay cut and all the base from the gage soft sheet copper Is is 3,2 by 6,2 in with two

lugs or extensions to in wide and ... in. lung. The total waith of the brank must therefore be 41... in Hammer one site, dril, hours in the lugs, and bend up. The

face is cut from a piece of the same material 3½ by 4½ m. The side lugs are each ½ by ½ m., so the finished width is artually 3½ in. The front lip is ½ in. wide, Cut out the center opening with a chisel or a jeweler's saw. Hammer, drill holes, and bend to shape.

For the pocket 24-gage copper is used. This is not hammered. The spring is made from 6½-in, length of 3/32-in, hard cop-

per wire

All riveting is done with brass escutcheon pins. The calendar is attached to the base with the spring, which also acts as a grip for a memo pad. Spring the two ends through the lugs on the face, then pass them on through the lugs on the bose. The V in the center should rest against the back of calendar,

Dissolve a small piece of liver of sulphur in a quart of water. After washing the pieces thoroughly immerse them in this until they take on a brown color then wash, dry polish, and project the surface with an open—R. J. Heartes.

MODERNISTIC HOLDER FOR A CANDLE

Because if its unusual modern design, this adjustable candle holder should appeal to ama our metal workers. The ring is a 22-in, length of 3/16-in, copper wire which is hammered flat and soldered or riveted at the joint. The piate is made of 16-gage sheet copper. It is given a hummered finish and holes are drilled as shown. The clamps are also of 16-gage copper.

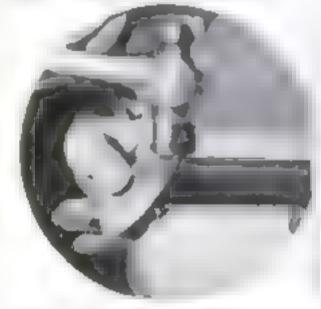
The column is \$/16-in, outside diameter brass turning .2 in long The bracket is of 18-gage sheet brass, shaped as shown The source a so is of 18-gage brass. It is cupped by hammering on the ins le and expanding to a depth of about ½ in. Then place a round hardwood stick in the vise and shape the sauter over this.

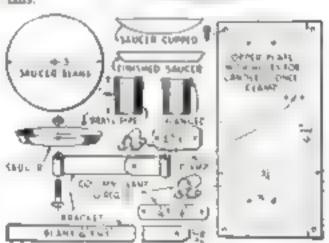
Drill a 54-in, hole through the

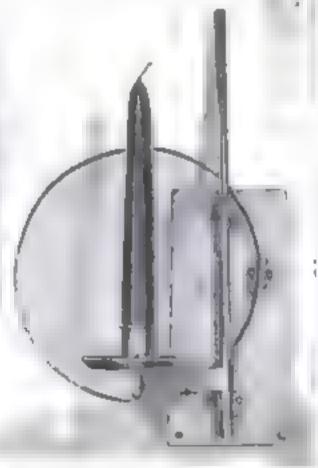
CONTRA

The randle cup is made from a 1 n-in, length of 36-in, brass tubing with one end flanged. Solder the cup into the saucer, then attach the completed cup and saucer to the bracket with a 1/2-in, round-headed brass machine screw. Sho the bracket onto the brass column and assemble the ent re candle holder Polish the piece all over and lacquer.—Dick Hutchinson

diameter with your fagers







The striking attemptitions of site ght and circular times and the contest between bress and copper make this camble holder easier any appropriate to use in any norm at a shed in modern style. The assure is humaneted over a round bardwood stick beid in the vise as in the circular

SIMPLY MADE COPPER BONBON DISH HAS FLUTED RIM



A, DA 500

The black with two of the flutes bent. The spacing is done by eye True fluted copper bombon dish is one of the simplest pieces that can be made by hand, and yet is useful and attractive. Cut a disk 8 in. In diameter from a shret of shiny new 72-gage soft sheet copper, and raw a 4 , in circle in the center The flutes are formed by placing a rod or piece of pipe ½ in. in diameter in the vise and pressing the edge of the disk down over it. Bend in to the line of the 4½-in, circle, as shown. Try to get the flutes as evenly spaced as possible, working from both sides. When completed polish all over, Lacquering should be omitted.— J. C. Whitcomb.

Small Portable ARC FURNACE

Fasily Built of Clay and Bricks with a time or a little beautiful cities in way ke and don't look at the atc. self unless you wear dark guggers

Robert B. Bistion

(ME world-lop experamenters see often stumped for the lack of a high-temperature furnace. It is relatively easy, however, to build a furnace like the one il ustrated, which

develops about 2,300 deg. F. and satisfies

all ordinary needs

Preparing Clay Misture. In a crock mix smoothly 5 lb, of known, 20 lb, of fire clay, 25 lb. of silica (white mand), and enough water to make a plastic musture Remove about 15 lb. and pound it on a board until all air is forced out. Repeat

with remainder. Allow to set over hight,

How the fewl is set up on bricks. A wood base should be pro-

vided so that the furnace can be carried eas ly by two pursons

keeping it covered with a damp cloth. Carbon Connections. Thread a 12-in. length of Ki-in, pipe, cut it in two, then drill and tap holes for set screws as shown. Fit wood handles on opposite ends and wrap with friction tape.

Construction of Borol. Make a disk of clay 101/2-in, in diameter and 3 in, thick, Form a strip 2 in. wide and 3 in. high.

Place this on the base, all along the edge, and smooth with moistened hands. Lay the pipes and nats on this wall directly across from one another and 4% in from the bottom surface of the base. Complete construction of the walts until 8 in. high, Construct the lid according to the drawings Set all in a cool place for four days, then remove outdoors for a similar period.

Baking Clay. After they have been air-dried. place the leather-hard

how and cover in a cool oven. Start with a temperature of 50 icit. F Every hour and a had take the heat 50 deg. until a temperature of 450 deg. is reached. Then reduce the heat 100 deg, every hour and allow the they to cool nowly. When root, drid the specified air holes.

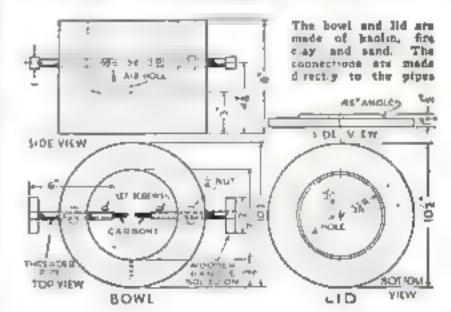
Laying Brick Lay common brick on sheet me al and ful in be ween them with clay. Prelure more clay, using same ratio as before. Set the bowl on the fire brick shoes. Construct a brack wall around the fire brack

and bowl as shown. Pack between the bowl and brick with powdered asbestos mixed with water Allow to dry thoroughly

Reactance and Connections All electric are furnices need a reactance. A simple one may be constructed by winding 210 ft. (1½ lb.) of bell wire around 270 strips of annealed iron wire. (For more informotion in regard to making a reactance see P S. M., May '33, p. 80.)

List of Materials

10 lb. kaolin or china clay (80c.) 100 lb, eilies or white and (\$2) 100 lb, fire clay No. 1, pyrometric cone errowalent taking 10 (78c.) 4 fire brink a ices (25c.) 4G common brick (30c) 6 lb. powiered asbestos (30c.) 12 in length of 1/2 in pipe and 2 nots for 2 arbons, 34 m 30c) 18 by 18 in 10-space metal (50cl) 6 a undam crecibles. 1 a. mouth (\$1.20) 210 (11, 16 bell wire (75c) 150 (t annealed ron wire No. 14 (35c.) 1 by 5 in board. 5 ft. lung (5c) Note The prices a parentheses are what the author paid. The fire clay and fire brick slices may le obtained from any utl-burner establishment.



JIG-SAWED STARS FORM COLORFUL

Christmas Candle Holders

By John C. Workley

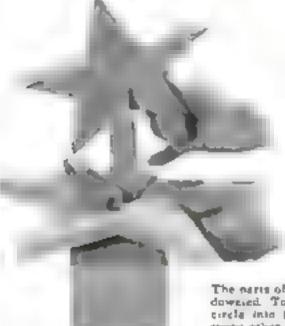
THE pg saw and the candle joined hands to produce these colorful Christmas novelties. The modernisuc, tree-shaped candie holders may either be set on a mantel or used to dress up the Christmas dinner table, but wherever direct they will add a gay and unique note to the Yuletide decorations.

S are or similar forms are the foundation for all the designs. They can be cut from wood ranging in thickness from 1/4 in 1 in , or from sheet aluminum or other metal. A band saw or a handsaw can be used instead of a jig saw in most cases.

One of the case it ways to lay out a five-pointed star is to draw a circle and divide it into five equal parts, using a protractor or the trial-and-error method. Then draw straight lines connecting every other dayison point.

The modernistic canale-tree consists of three star-shaped pieces mounted on a base and spaced by uprights of aquare or round cross section. Near each point of the two large stars, and in the center of the small one are cancles, eleven in all,

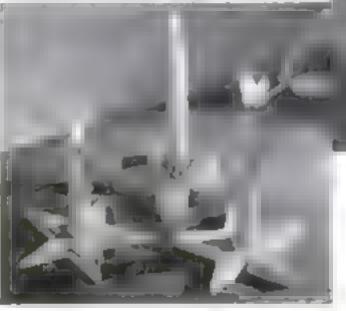
Assembling the base of a true-shaped condic hower the that shown at the right of this page. Solid wood can be used if you prefer



The base is 4 in, square and 3 in back. You can cut it from a some back of wood, build it up by gluing 3½ by 4 in blocks together until their combined thick ness is 4 in, or make it from five pieces of wood whose joined edges are cut on a 45-deg, miter. The latter method is illustrated, In this case the surfaces of the sidepieces were grooved to increase their attractiveness, but this is not necessary.

The lower star is cut from a circle 12% of in diameter; the middle one from a circle measuring 8% in., and the upper one from a 4-m, circle. The material should not be much more than ½ in, thick

The upright between the base and low restar is about 1% in square and 1° in long. The one between the lower and now die star is 1 in, square and 3% in, long. The remaining upright is about 2% in



A he der for sheven rand as made in the shape of a choice of a Christian Christian Ar total Three individual cand a horders

square and approximately 4½ in lone. The candles should be 6 or 7 in long

when new A simple and effective way of mounting them is to drive slender nails through the two larger stars, from the underside, about 15% in from each point, so that the nails project upwards for about 1 in. To prevent splitting, it is wise to drill holes slightly smaller than the nails. A nail with its head removed is driven into the center of the topmost star to support the upper candic

The parts are held together by 1 to wood dowels glued in place. Bore 5,-m.

boles through the centers of the stars and into the ends of the upraght pieces for a distance of about 1 in, and also in the center of the base Before assembling, lacquer the stars a brilliant green and the base and upraghts rel. Arrange the stars so that the candles of one

will project upward between the points of the next one, as illustrated.

The simplest candle holder is a star sawed from 1/2-in, wood and lacquered some bri hant color or rotor combination. The candle can be held by a had

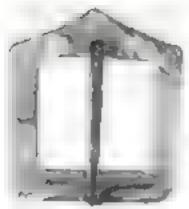
set in a bole bored in the center of the star, or inserted into a little cup formed from sheet copper or lead. Incidentally if you use nails for holders, you will find that the candles slip into place easier if the nails have been beated with a small torch or candle flame.

Another form of candlestick consists of two or three stars of progressively smaller sizes mounted one on the other and each painted a different color. Fancy woods can be combined and finished to show their natural grains. For variation, you can tut the star edges on an angle, in doing this, you will find the jig taw almost indispensable. Tilt the table and use a slender blade that will enable you to turn corners easily. For straight cuts with a level table, a wide biade is better because it has less tendency to wander.

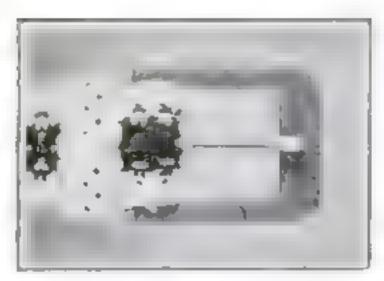
If you find that you will have too many stars scattered about, you can add variety by making candle holders or modernistic trees in some other form. As a suggestion, a candle base that has five points shaped like the petals of a flower is illustrated. A wood poinsettia with bright red petals and a yellow candle in the center would be particularly appropriate.

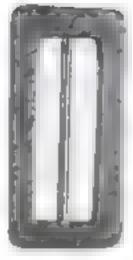


The name of the large candle tree are downed. To draw a star divide the circle into five equal parts and join every other point with straight lines



Four completed bucklets. The th rd is built up of two theknostes with a steel rad set in between







Homemade Celluloid Buckles

LEND ADDED BEAUTY TO KNOT-WORK BELTS

EALLY useful gifts are the kind most appreciated when Christmas rolls around, and few suggestions could be more appropriate than to give attractive cord belts with handmade buckles designed particularly for those who are to wear them. Such individual buckle-and-belt sets have an expensive look, but, luckety, the main cost is in the time required for making them. The materials themselves cost but at let

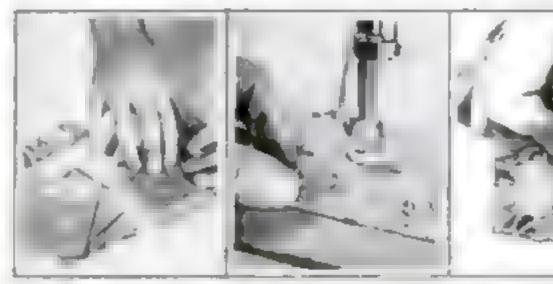
How to make the belts has been told in previous articles of this sense (P S. M., Nov. '32 p. 77, May '33, p. 63, and Sept. 33, p. 65). The present article will give suggestions for preparing

suitable buckles.

Heavy sheet celluloid is the material used, and it is surprisngly easy to work with. Six piain colors are available, as welas tortosse jace mortled biege and onyx. Cedalcal that is about . 10 n thick is best bipuares of 2 or 3 in. are required for each buckle. The scraps may be saved for inlay work in other materials. Material of this thickness and in the different colors can be obtained from stores and mail-order dealers specializing in handicraft materials. It should be remembered that celluloid is inflammable, but small pieces of the type described afford negligible danger, being slow burning and easily extinguished

First draw the design (several sample designs are illustrated) or trace one on thin paper placed over catalog pictures, if you happen to have a ca flog showing craf workers' buck es Cement the driwing or tracing to the celluloid squares with rul but cement. After driling small bows for the blade you are ready for sawing.

The malerial cuts very casily A fine blace should be used in the (Continued on page 75)



1 The designs are drawn or 2 it often improves the appear. 3 Cutting an initial with a traced on paper and subber- 2 nace of a buckle if the new 3 tool made by sherpening denomined to the calluloid stock table is tilted about 15 degrees the point of a ball V-shaped

5 If the glossy finish is merced by accratches or ac-

eidenter file murke, it aun be

instanted by flowing acatone

over the celluleid on at left



The notch for the topgou the callulo d with the edge of a five and fives and sandpaper are used to amough the edges of the buckle and remove all stregularities left by the new

A Money-Saving Christmus Hint

 $\mathcal{R}_{\mathcal{Y}}$ KENNETH MURRAY



6 The tengues are made from 12 or Delaenne spas-ti brass wire bent on shown, then hammored to harden there

7 After the tongue has been all pped in place on the buchle. the beat end may be closed with a patl set





A wood-finishing demonstration before the club at Rockford, Ila., which holds Cherrer No. 1 an the Hattonal Humaworkshop Quad

What the NATIONAL



HOMEWORKSHOP GUILD

will do for you

HAT is the National Homewarkshap Gu h 🔧

How can I become affiliated

"What wall the Guild do for me?"

These are the three questions I am asked most frequently. I shall try to answer them as definitely as possible in his or sole for the penetit of all who rolke a holiby of their home workshops. Since POPULAR SCIENCE MONTHLY has consented to act as the official magazine of the Guid, I feel sure that its readers will be keenly interested in knowing what the Gui.d movement stands for and what it will do for the amateur craftsmen of the United States. If there is anything further you wish to know after finishing this article, please write me personally at the national headquarters of the Guild, 312 Harper Avenue, Rockford Ll.

To begin with, the National Homeworkshop Guild, Inc., is a noncommercial corporation chartered in the State of Illi-

nois to promote and encourage the forma ion of clubs for the advancement of ad classes of what may be called homecraft -ad types of home workshop actaines and all branches of amateur craftsmanslep. In announcing the formation of the Guild last month. Port LAR Science M- without put it very clearly when it sain the Guild is to be a great

matual seneral association for those who todow any type of

hancierast hobby

If you read the Home Workshop Department of this magazine regularly that is t a one is subnetent indication that you should be allocated with the Guild But how can you become affiliated. That is very simply accomplished You must be a member of a loca, bome workshop club

having not less than five members. The total crub then obtains a charter as an

affinate in the National Homeworkshop Guild, Inc., and immediately is entitled to all the benefits and services of the Guild, A little later on I shall tell what these benefits and services are, but first let me es, an about forming a local club.

The officers of the National Guild have had considerable experience in this work recouse they organized the original club

in Rockford which has been so successful. A typical meeting of this club is illustrated above. We know how a club should be run. All this information is at your disposal in a complete bulletin that has been prepared on the subject of forming a local home workshop club. You can have this free at once simply by sending a large self-addressed, s'amped envelope and the

coupon given on page 8,

The bulletin explains how to obtain

BY LEVERN T. RYDER

President, The National Homeworkshop Guild, Inc.



names of prospective members where to how meetings how to cale the first meeting and conduct at how to apply for although with the National Homeworkshop Good how to choose a name how to prepare your local constitution and by laws, how to arrange for adequate publicity, and what to avoid. I cannot go into all this in the hunted space available here, but I can assure you that you will have no deficulty in organizing a local club if you follow the suggestions given in the outern

Let me now outsing briefly the more important things that the National Homeworkshop Guild will do for each local club

allurated with it,

First and perhaps most important, it will provide all the information necessary to make your club successful—information such as that contained in the bulletin just mentioned. Once a month the Guid will send the secretary of each affinished club a bulletin or news letter. Some of these will contain detailed and carefully studied plans for conducting one or more meetings, others will contain information on exhibitions, contests, and

All topics of interest to local clubs. Second, the Gund will conduct a speakers' bureau. Much information has already been assembled as to where speakers and demonstrators may be obtained by the local clubs. The club in Rockford always has some informative address or demonstration as a main feature of each meeting, and its experience in building up such programs will be placed at your disposal, Various large manufacturers have promised their utmost

support to the Guild and are willing, when a sufficient number of clubs have joined the organization, to provide expert instructors and demonstrators who will go from club to club. This service will be developed as the organization grows, but meanwhile the Guild will be able to show you just how to develop interesting programs and find good speakers in your own locality.

In the third place, the Guild will provide information on club projects and community projects. Nothing will add more to a club's popularity, for example, than to make a number of toys for poor children or orphans, and this can be done very easily and inexpensively by dividing the work up among the members. The resulting publicity is likely to bring in new members and will enhance the prestige of the club in the community

The Guild, as a fourth service, will help you find just what type of work you can do most successfully and with the greatest pleasure and profit. In recent years the home workshop has grown to be an institution of entraordinary diversity. The divisions, the possible projects in each branch, and the machines, tools equipment, and materials are almost beyond cataloging. The Guild will show you the whole field so that you can pick out the specialties you like best.

Fifth, the efforts of the Guild and afthated clubs will be given unity and made



Immeasurably more effective by having Port LAR Science Monthly as a national organ. All the important news of the organization will be published in this magazine. Not only will the formation of each local club and the names of its officers be reported but all the activities

of the Guild will be given adequate editorial support and pubtons.

Finally, the Guild through its national officers, will endeavor

The Go Id will good y univer whatever questions arise in organizing and directing clubs

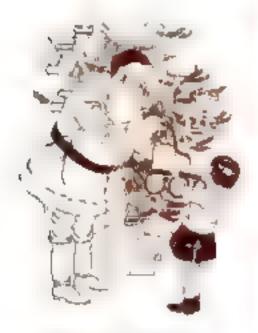


to answer the questions that arise in connection with all local club activities. As the organization grows, an information bureau and reference library will be built up that will be invaluable to the amateur craftsmen of the United States.

The dues, so far as the National Home-workshop Guild is concerned have been tried as low as possible. Each local clab task to the Guice 50 cents per member per year for the sole purpose of promoting the work of the transl. Perh, ps the greatest long about the Guil is the fact that

it is entirely noncommercial. It has nothing whatever to sell. Its officers and directors are giving their services free. They have defrayed out of their own pockets all the costs of organization. Furthermore, they have the advice and support of an advisory council of men of national distinction, all of whom have freely volunteered their services.

In the very same spirit, POPULAR SCIENCE MONTHLY has extended the utmost cooperation to the Guild. Its editor and home workshop editor have both (Continued on page 87)



Making toys for orphass and pour children is one of the finest community proves a for any club to undertake

Six Great Services

Proceeded by the National Home a the top Guld

Bulletins, news letters, and all instructions necessary for making a local home workshop club successful.

2 A speakers' bureau for giving information as to where lecturers, instructors, and demonstrators may be obtained.

3 Plans for community projects, exhibitions, club and group projects, and handicraft contests A survey of the whole home workshop field so that you can find your own best specialties in it.

5 The prestige and editorial support of POPULAR SCIENCE MONTHLY, which is the official magazine of the National Homeworkshop Guild.

An information bureau for answering questions that arise in connection with focal club activities.



Good Luck National Homeworkshop Guild Well Do Our Part!

IS our belief that the formation and



National Homeworkshop Guild, as described elsewhere in this magazine, represents



one of the most important steps ever taken in the organization of handi-

craft activities over the entire country. Nor could a more opportune time have been

chosen for



its inception. Now that men in every walk of life find it

necessary to adjust their ways to the use of more leisure time, thousands will find

in these local clubs a new and intriguing solution to their spare-time



problems. And to the hundreds of thousands already spending

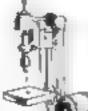


happy hours in the pursuit of homecraft hobbies, the Guild offers



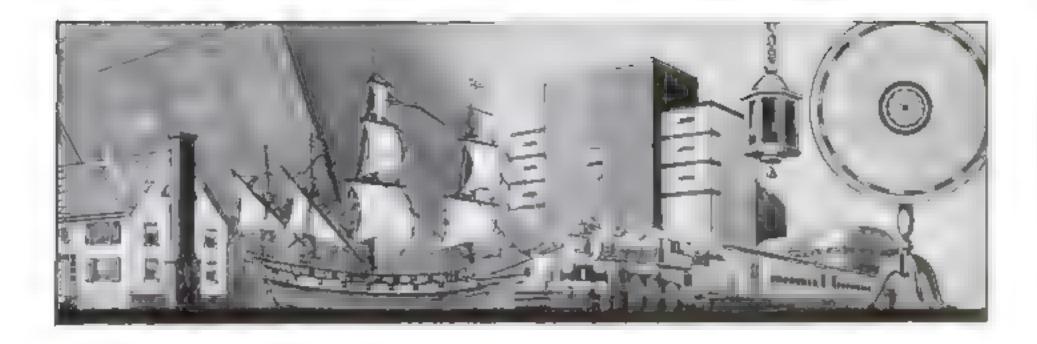
tunities through the cooperative efforts of its associated clubs. The undersigned

congratulate the



organizers and wish them every success. We invite all

use us as a source of information. The experience of exclub members to



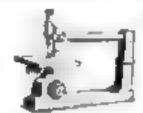
perts employed in every experimental and research phase of



homecraft work

is always at your disposal. And to those who desire it, first reports of all new develop-

ments in these companies will be



available. Again let us extend our

hest wishes and our hopes that from this modest beginning will arise a series of clubs

throughout



the country, promoting homecraft work and spreading the

message of pleasure and profit which these splendid activities bring to every man.

E. C. Atkins and Company Indianopolis, Indiana Atkins Silver Steel Saws

The Carborundum Company
Niegara Falls, N. Y.
Sharpening Stones and Grinding Wheels

The Casein Mfg. Co. of America, Inc. New York, N. Y. Mirs. of Casea Waterproof Glue

Delta Manufacturing Company Milwaukee, Wese. Makers of Quality Motor-Driven Tools Henry Diaston & Sons, Inc.
Philadelphia, Pa.
Sawa * Tools * Edes * Konver * Steel

William Dixon Incorporated Newark, N. J. Mfec. & Imp. of Tools for Arts & Crefts

Greenlee Tool Company
Rockford, Itl.
Bits, Chicels, Turning & Mortising Tools

The Irwin Auger Bit Company
Wilmington, Ohio
The Irwin Bluwin Bit

Millers Falls Company
Greenfield, Mass.
Millers Falls & Goodell Prais Tools

Nicholson File Company Providence, R. I. "A File for Every Purpose"

Russia Cement Company
Gloucester, Mass.
LePage's Liquid Gine and Cassin Gine

Stanley Tools

New Britain, Conn.

Hand Tools, Electric Tools

Walker-Turner Co., Inc. Plainfield, N. J. Mira, of "Driver" Power Tools

Darkroom in Any Home

By Frederick D. Ryder, Jr.

The collect darkgoom in which the air her works. The window at the left is made nightproof by a pywood bland. The workbench and chemical average abelyes were but, from the cheapest yellow ping abeathing.

RRANGING satisfactory narkroom factaties without upsetting the rest of he family is one problem every amateur photographer has to face as soon as he gets beyond the press-thebutton let-someone-else-do-the-rest stage of the hooby

Indeed, many amateurs of the type to whom developing, printing, and enlarging make a strong appeal are scared off by the apparent difficulties. Actually it is quite easy to fix up a good darktoom without disturbing anyone, even in a small apart-

men

The first question: How dark must a curkroom be and how can it be made that way? The answer depends on what work you expect to do. If you have a roll-firm camera develop your films in a daylight-loading tank, make prints on velox or atmilar paper, and do not go in for bro mide enlarging, any room in your home will be dark enough at night without even bothering to pull down the shades

If however, you develop toll films in a tray, develop film packs, but films, or plates, or do bromide enlarging you must have a darkroom that is absolutely free from light. A perfect darkroom, photographically speaking, is one you can sit in for fifteen minutes with all lights out and at the end of that time not be able to see a single thing—not even so much as a vague hint of light around the door or

window frames

Your first thought will be to hang bankets over the windows to cut oil the light. That will do in an emergency, but is a nuisance as a regular practice. It is much better to fit light-proof blinds to the windows and fix the door so no light gets in around the edges. The details of this job depend on the windows in the room and the type of door, and they, in turn, will differ according to the room you choose or must, through force of circumstances, use for your darkroom.

If you live in a private house, obviously the best location for the darkroom is the cellar, preferably in the laundry where



For any window such as o this bath com, a bind can be made from a piece of he n. pressed wood board edged with black valvet

there is running water. In a small apartment the bathroom is a logical choice for the same reason. On the other hand, any arrangements you make in the bathroom of a small apartment must not interfere with its normal use or make the room unsightly, otherwise there will be atrenuous objections from the other members of the family

The kitchen also is an excellent choice, especially the modern type with its large single or double drain-board sink. A point in its favor as a darkroom is that ordinarily you can have undisturbed use of it after the supper dishes are out of the way

Bear in mind that running water is not an absolute necessity. If I were forced to choose between any reasonably large closet that I (Lantinuca on page 7.2



A Chance for Everyone in Our New \$50 PRIZE PHOTO CONTEST

NOU have no restrictions to worry about when competing for one of the eight prizes in our new \$50 contest for indoor photos. The subjects can be any thing you please, and the prints may be of any size. Only the quality and the general interest of the picture itself—not its size or mounting or finish—will be considered. This gives you an even chance with every other smateur photographer, because the new lights and sensitive films now available make it comparatively easy for anyone to take good indoor obotographs. You can do the developing and printing yourself, or have it done by a professional

FIRST PRIZE _____825
SECOND PRIZE_____15

photo-finisher, as you prefer The contest is open to any amateur photog rapher except employees of Portunal SCIENCE MONTHLY and their families. You may enter as many different prints as you please. Mall them to the Photographic Department, Populan SCIENCE MONTHLY, 381 Fourth Avenue, New York, not later than February 1. 1934, and mark your entry "January Photo Contest." It is not necessary to send the films. No prints will be returned. unless a self-addressed, stamped envelope is inclosed. In case of ties, each tying contestant will be awarded the full amount of the prize tied for-

THIRD PRIZE......5

FIVE PRIZES, \$1 meh...... 5

EASTMAN'S Annual Gift Guide

• Sharpshooters for experts.. sure shots for beginners—there's a Kodak gift for every need. Kodaks for ministore snapshots... for large pictures. . for movies... for "stills"... whatever your picture-making desires, there's a Kodak that fitts the bill See these latest cameras at your dealer's... make this a Kodak Christmas. Essuman Kodak Company, Rochester, New York.

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DETRA-FAST LENS... AN ULTRA-FAST SHUTTER— AN ULTRA-FINE LAMENA

The ray Kodak Popiliers a gem of a camera that for in the pain in it your hand. A gift for the camera enthation. Taken 16 sharp, a set pictures without releading. Price with / 2 Anast gent Jens, 1/500 record, Compar shares, sange hades, two color filters and case, \$75,



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MOVIE CAMERA

on the first of the control of the c



BOYS AND GIRLS

GIVE A KODAK . IF IT ISN'T AN EASTMAN, IT ISN'T A KODAK

STOPPING LEAKS WHERE THE METAL IS THIN

THIS is the easiest kind of a Smooth-On repair to make and anyone can get good results

Merely mix the Smooth-On with water until it forms a putty. If the leak is at a seam, pry open a little, clean off, and force the Smooth-On in with the finger or a knife blace. At a rusted spot, scrape off the rust, force the Smooth-On through and press it to anchor on both sides. At small holes, put the Smooth On between washers noute and out and use a small machine screw and nut for drawing up tight

Smooth-On No. 1 forced into seam openings, between rivels, or into the holes quickly meta see and thereafter in tight against hot or cold water, steam smoke, oll, gasoline, gas, etc. It holds in any metal and can be used as well to stop leaks at Jointa and crucks in cast or wrought metal pipes, radiators, boilers, and surnaces. Use it also to tighten lunse handles and to anchor loose bolts, screws, etc., in metal, concrete, tile and

By following the sample directions in the Smooth On Repair Bonklet, you can make dozens of home and automobile repairs at a very small fraction of what a repair man would charge, and if you keep a small can of Smooth-On ready for emergencies, you also avoid annoy he delays.



100

Eugani On

Radiator

Leany Pail

Looky Kettle

1

Leaky Tank

Oil Lealer

Get Smooth-On No. 1 in 7 oc., 1-th. or 5-lb. sins at neurest hardware store or if nacessary direct from us.



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Nune	i li-1 -	
Address		

1 34

IT'S EASY TO FIT UP A DARKROOM

(Continued from page 6a)

come use exclusively as against the uncertain. Then there where he permissible if of exactly tenancy of a backroom. I should anheotat ingly choose the closet. Carrying a few pails of water of an evening is but a small price to pay for no interruptions.

Ce tar windows are usually small and cares fitted with aght right bund, made of his plywood or presed-wood board. The exact method of fitting depends on the type of winds will be or small importance in the cellar, so all you have to remember is that light cannot get around two right ancie corners that are painted flat black, even if the joints are quite loose

The commost illustration on page 68 shows a corner of a cellar darkroom. The window at the upper left is fitted with a plywood blind. Three dollars' worth of yellow pine sheathing-about the cheapest fumber you can buy-supplied the wood needed to huild the workbench and chemical storage shelves, which are placed next to the enameled from tub tops. This a convenient arrangement gives you lots of room to work, and does not interfere with the normal use of the faundry tube on wash day

IF YOU will examine most bathroom or kitchen windows, you will find there is a flat surface on the frame all arount the casement that is broken only by the great ing all at the lastiam. The second show graph on page 68 shows a blind bring applied to such a window. It is made of 14-in pressed-wood board with a strip of black velvet gibbon glued close to the inner edge and around the bottom edge where it rests on the sill. When held in place with a few thumb tacks or tiny awarging wooden cleats, B is absolutely light sucht

When not in use, the blind can be feet standing behind the radiator where it will not be in the way and will hardly be noticed if the inside surface is pointed to match the walls. I have seen one blind of this type that was eleverly enameled and lined to match the filing

But little light neto through most reasonably well-fitted doors except under the lost tom. There sometimes is as much as a space between the door and the sill or floor Glue the edge of a thin velvet ribbon close to the bottom edge of the door to curtain off this unwanted light. With poorly fitted doors, such as a cellar door, or one that has warped body, it may be necessary to glue a strip of ribbon all around the edge to stop light coming around the jamb. If the door is of any dark color, the ribbon can be of a matching color to make it inconspicuous

Once you have the darkroom reath oark the pest july is to install a safe darktonelight. The fort lliestration on page 65 shows the obcapest form of safe darks on light. Colored glass screens of different a neranging from the exceedingly dim cross that is safe with panchromatic film, if used with discretion, to a bright yellow that gives buts of the stages were to be or arches or mainte papers are obtainable for the light and are cas shoped onto place as indicated. You can buy these safe-light screens separately on this smallest size or in larger sizes, if prefer to make year swn salit fight set for

REMEMBER that only the teakers of the films, plates, or paper you use really know just what kind of light and how much of it their products will stand unbout the must. If you try to fix up a darkroom light with untested material such as red green, or orange electric light bulbs, you will either have too much of the wrong kind of light and for your films or have a much dammer

the right color for the work you are doing

The next problem is where to put the trays. This is simple in the cellur darkroom illustrated because there is plenty of working space. In a kitchen darkroom, the drain board of the sink does for the developer, short-stop, and fixing trays, and the sink itself serves for a wash box if you knock the bottom out of a small tomato can and place if over the drain so that the water has to tise to the top of the can before flowing out

The modern bathroom washbasin ture.y offers a safe support for one tray, let alone three. One solution, if the arrangement of the room makes it convenient, is to cut a wide board long enough so that it can be supported lengthwise or crosswise on the lub-The latter, when 6 ted with water, makes an acceptable wash tank

If the room is planned so this is not convenient, it may be possible to make a detachable shelf that will fit on top of the touct flush box after the porcessin cover has been litted off. This works well if the flushbox is bearle the washbasin and at the right he chi

In the cluset type darktoom where there n no running water, the most difficult probkem is to get your hands clear of hypo before you put them back in the developer The answer is to carry in two pads nearly full of water. Always rime your hands first in one and then in the other in the same order then dry on a towel. This double zinsing will remove so much of the hypothat what's left on your fingers won't do any

THE first washing, too, can be convenining water. Anequately complete washing of an photoscart com plate, or paper to estated . the water in the tray is changed at wast see there at five-minute intervals One empty pay time which he must be our canned waren are no all other remarks both the Jahren Circle Links of he tray will have fore do the trik. This me has a washing saves quite a fot of water, which is a ma terof importance if the water rate is high in your locality

The last and perhaps the most important of all darkroom problems is the matter of cleanliness. Photographic developing and printing are deticate chemical processes. Uns lorm and substantiony results cannot be obtained with duty trays and cureless handurat that allows any chemical to get where it does not belong. Dish washing is not consalered a recreation whether it is practiced in the katchen or the darkboom. Nevertheless you should make it an invariable rule to risse out every tray (horoughly und to mop up every drop of spilled solution before ou quit for the might.

This is the thirty-first article in the photographic series by Mr Ryder He has covered practically all the more extented information necessary for successful amateur photography, but additional articles are being planned and the series will be continued as long as readers are interested. If there is any particular topic you wish Mr. Ruder to dischit, please drop a line either to him personally or to the Home Workshop Department

A HINT ON LAYING VENEERS

A GREAT and to successful veneering is to use cellophane between the coul and the vencer instead of paper. Unless left for some time, the peliophane will not stick to the chie thus saving much work.- J H BEEBLE

It's EASY to snap CHRISTMAS PICTURES



JEAN, THESE INDOOR PICTURES ARE GREAT, WE'LL REMEMBER THIS CHRISTMAS EVEN WHEN THE CHILDREN HAVE GROWN UP



What fun! Picture the children tearing open their gifts ... Grandma under the mistletie ... eres of joyful Christmas scenes indoors, It's EASY , value new GI Mazon Philadalm,

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HIS month you have your choice of two new consequetion kits that are in many ways he most unusua we bayr

ever offered. One, marked K in the lenewing hel, commine ready to-assemble materials for what is he ever to be the lich est fastest 20-in more raying smop ever designed. It is made mainly of late fiber or tag board. In the kit are more than eighty separate stems.

The lines are those of the 12-square-meter international racing sloop Sharme, and the new method of tagboard construction was devised by Louis P. Hall, Jr.

The second kit. marked L, contains all the raw materials (except paints) for building our new ships model, Farragut's than to plant ford The monget to 41 in this over all and 5 ib high, and is the finest a our entire series

Following is a compiete list of our acts. all of which are accompanied by the structsons or blue-

A Whaling ship mone, If sudger All the raw materials-wood, were fishing one characellword and every bing but the paints together with bineprines Nos 151 to 151 and bonklet. The hall is 200 in ming to 30

AA. bame with had lists sawed . 740 D. Spanish gauese slup model, 74 in long. All the taw materials tescept paints), Blue mints New to and 47 and a law airt to 45 DD. Same with the two main bull blocks

shaped grant and account to 6.95 B. Hattleship mode! U.S.S. 7 re 3 t long. All the raw materials (except paints)

and Bucprints Nos. 197 to 200 6.95 EE. Same with hull lifts sawed 7.45

F. Liner Manhatton, All raw muterinia (except puists) for a simplified miniature model 12 in long, and Blueprint No. 204, 1.00 G. Elizabethan galleon Revenge, Ali raw

materials (except paints) for a model 25 in long, and Blueprints Nos. 206 to 209., 6.75 GG. Same with bull blocks shaped, 7,25

H. Cruser U. S. S. Indianapolis, All raw materials (with examels) for a simplified 12-m. model, and Bineprint No. 216, , 1 50 J Clipper ship See Witch. All raw materials (except paints) (or a simplified 13-in.

model, with blueprint, 1 50 K. Jute filter (tag board) scare model of Shorple racing sloop with 20-in, huli. Can be used as decoration or sailed. Very light and fast. No tools required 2 00

L. Farragut's flagship Hart ford, a steamand-sail aloop-of-war. All mov materials (except publis) and special Blueprints Nos-221 and 222. The Bull is 33/7 in long, and the over-al. length is 41 in, ... 7.95

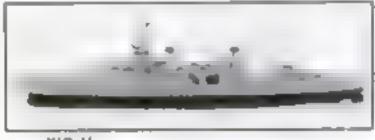
LL. Same with high I is sawed 8 45 No. 2. Solid maliogany tray-top table 23 in high with a 15 in, diameter top. Ready to assemble but without hinshes

No 4 Soud mahogany book trough 22 2 in une 0 , in wide and 2+ 4 in high over al Reads to assemble, with finishes 5.30

No. 5. Solid rock maple banging was rack with one drawer, 19 , in wine 33 \$ in, high Ready to assemble and stain included 575

No. 6. Solid rock maste butterfly table, ton 19 by 22 in height 72 a h. Ready to assemble and stain included





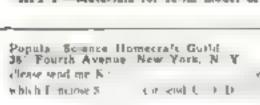




KIT F-Materials for 12-in, model of Manhattan

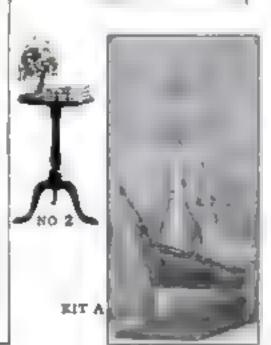


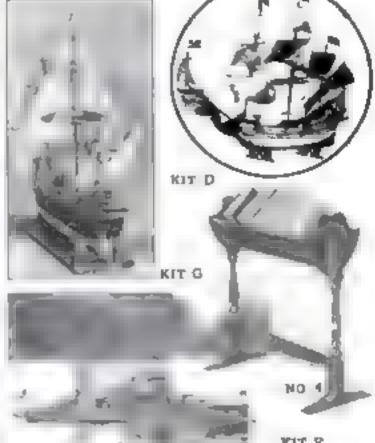
EIT J Materials for a energiance clipper ship



the commence States -Fr. sie Jefal neme very charly.)

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GRINDING DRILL POINTS FOR DEEP HOLES

A large manufacturing plant experienced considerable drill breakage with unusually deep holes in custings, especially those sizes



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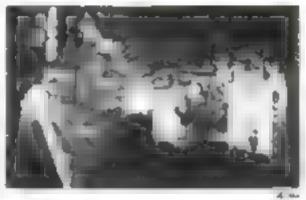
under 5% in. It was finally discovered that grinding the points as shown increased the production from 60 to 65 percent. Lap & cuts first, the chip heing half the with of the lip and nearer the center of the hole. Lip d aboruts the chip for

half of the width, but the farther half from the center of the hole. The chip is thus divided by the two lips, and a free cu, and action results. This naturally a low a considerably necessed feed—Rector J. Characterians.

Fascinating new Game!

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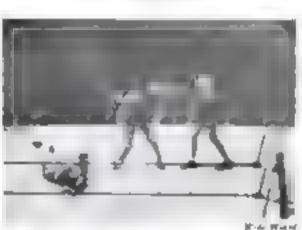
RADIO TOUR



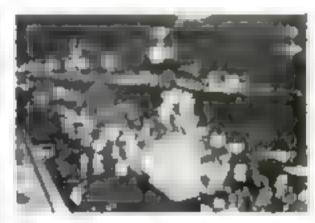
A "First Night" in Hollywood- get the thrill



Smar Indians in the Black Halls stage a primitive transit denies in the an adventure on a Radio France



Ringside" at Hedison Square Garden . be there for the big higher on a Radio Tour



Ride essat Rader en the Marti Cenn - get to a glassi-ja pest color resur ng via Rajasa?

.. Your copy of the 1933 Home Workshop INDEX

HOW often have you hunted through your back copies of Popular Science Monthly to find some home workshop article you distinctly remembered seeing? And what a job it was! No one ever realizes what a wealth of material is published in this magazine until he has to go through a number of issues to find some particular item.

You can save yourself all this trouble by using the Home Workshop Annual Index. This lists alphabetically every article published on craftwork, shop methods, house repairs and short cuts, model making, radio, automobiles, and such hobbies as chemistry, microscopy, and astronomy. It is a complete and carefully gross-indexed key to the most up-to-date reference material on these subjects that can be found anywhere.

Your copy of the 1933 Index is now ready and will be sent for ten cents to cover the cost of printing and mading. A few copies of the 1932 Index are also still available

Popular Science Monthly

381 Fourth Avenue, New York, N. Y. Please send me the Home Workshop Index or Indexes the their for which I include her cents rath

		1933		1932	
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Throw out old, worn-out radio tubes... re-tube with new Cunningham or Radiotrons—get in the game!

HERE'S a chance to get in on the greatest game evet devised for radio act owners!

Don't confine yourself to five or air stapans there are more than 650 to choose from . . Go on a Radio Tour! A turn of the dul and you're touring North America! Drop in

on Miami hear a dance under a warra tropic moon join a barn dance out in Indiana... get the thrill of the Marda Gras in New Otleans

a 'First Night' in Hollywood hear those powerful stations in Mexico From Maine to Califotnia, the game is on—get in it!

Here's all you need to start playing. A

good radio set, with a good notenna system -Mar a new ser of Cunningham radio tubes or RCA Radiotrons. Don abe held back by worn, "stick-in-the-mud" tubes. Step our torught with the world's finest—the only tybes guitanteed by RCA... built with 5 great new improvements undresmed of when most people bought their rubes. To make it easy for you, we'll send you a large 4-color "Radio Tours" map showing at a glance all the radio stations in the United States, Canada and Mexico, with call letters and follocycles . . . And the remarkable new "Radio Set Performance Yardstick" devised by RCA and the Cunningham engineers. It rells you whether your set is in excellene, good, fair or poor operating condition. Get this exciting booklet "Radio Tours" with the new "Radio Set Performance Yardstick" from your dealer or send tile in stamps to cover handling

and making to RCA Ratiotron. Co., Camden, N. J.



(Conjunctivises to RCA Radiotron Co., Cambro, N. J.)

I am exchang 10c m samps for possage and handling



HICKORY PLACE CARDS AT WOODCRAFT DINNER

AT a manquer I recently attended in bonor of fathers of Boy Scouts, the favors were pieces of green bickory sawed and labeted as shown in the accompanying tiastration. The Scouts obtained the small hickory tree trunks while on their likes, and the local high school shop teacher sawed the sticks diagonally into sections approximately 1/2 in thick.

In using the idea, any available small tree trunks or branches other than backery. may be used. The diameter of a cross section of the wood may vary from I to 2 in If a power spw is not available, the wood can be held in a vise and sawed by hand Avoid marring the bark, which adds to the woodcraft look. Remove the saw marks with sandpaper, then cost the sections with thin shellar and letter with Inda ink -- George A. Smith

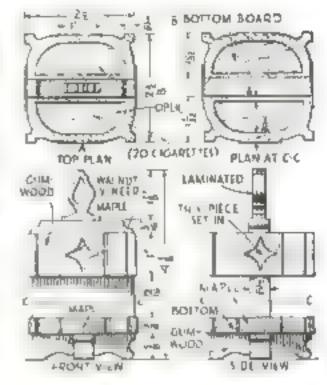
NOVEL JIG-SAWED CIGARETTE HOLDER

THOSE who wish to try something new in the way of a jig-sawed project will find this eighteite bolder a novelty that is at once interesting to make and useful when completed. A number of them could be made up for Christmas presents.

The holder is made of gumwood, each half being cut out on a jig saw and glued to a solid centerpiece 7 16 in thick, as shown in the accompanying drawings. Each section holds ten cigarettes. The toppiece which is I in high, is the same shape as the lower piece, but the latter is only 34 in, high. The grain of the wood is vertical in these pieces. A 5k in thick buttom is glued in each half of the lower piece

Walnut veneer with maple inserts in gloed on the upper part of each side to add interest to the design and to cover the joints between the contempede and side sections. The same expedient is used to hide the joints in the lower part of the holder, but only maple is used here

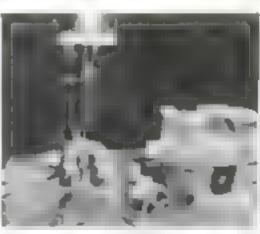
The handle is laminated The center



Weeking drawing with principal demaps one



The holder to star to peas around and a so well keep two different brande of organities separated



Cutt ng the parts for the holder it very much libs making a picture quitie-

piece has the grain runrung across, and the two outside pieces have the grain running vertically

Wa nut color oil main was brushed on to darken all the wood but the maple inlays, and then two coats of thin white sheling were applied for a finish.—
TH MAR B. OWENS.

Note. This design was awarded a prise he one Novelly Jig-Soreing Contest tiee PSM July '93 p. 637

ROUND GASKETS CUT WITH RAZOR BLADE

Rotrag gaskets of poper, cork, or felt are often needed in the garage or workshop, but are very deficult to make quickly and accurately without the use of some form of circular gasket cutter Such a cutter can he easily made from scrap material.

The base is made from a piece of 36-in, hardwood about 12 in square In the center a small hole is bored, and into this is driven the center pin. which is a 6-in length of light, stiff wire such as the ordinary wire coat

opposite end to make the center hole in the gasket material

An old inner tube valve stem is denied out so that it will just sup on over the center pan, Another piece of said ware forms the arm of the device, the middle of the wire being best around the valve stem and securely clamped between two regular valve-stem puts. The ends are then joined by bending them together and

A bole is bored in a 36 by 134 by 134.

soldering. Space the wires so that a 1/2-in

bolt will slide freely between them.



A wire center pin an old inner tube valve etem an erm of at ff were and a resor blade mounted on a block form this cutter

hanger is made from. After it has been to hardwood block as shown for a 2 by tightly driven in, a point is filed on the ..., in carriage bolt. Two grooves are filed in the top of this block for the wires of the arm to slide in. The carriage bolt is fitted with a thumb nut and a plain washer for clamping the wires

The razor blade is held by a small round-headed screw and a washer It should be adjusted so that the cutting is done by the corner of the blade

The gasket material to be cut is pressed on over the sharpened point of the center the. The valve stem is next slipped on and the blade set to whatever radius is depred.-L. C PTLTER

BOBBINS TO AID IN KNOT WORK



The long cord ends are dept imcome til

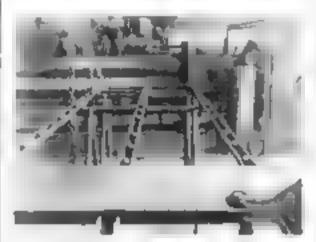
To KEEP the long ends of cords used in fancy knot work from becoming anaried. they are ordinarily Geometra banks, but I have found it better to use small wooden boluers or bubbling like that illustra ed. The end of he string is passed through a hole in the bobbin and knot ed. Then the reserve supply of string is wound on, and two

half-bitches are taken around the longer ear of the bobbin. Since one can pull as hard as necessary against these bitches, it is more convenient to use the hobbin as an and in pulling than to depend on one s lingers atone. When more string is needed, the line is unhitched, one or two turns are taken off, and it is again temporarily batched on -R. S. TALCOTT

CHOOSING A MICROSCOPE BULB

When making a microscope lamp, it is advisable to use a so-caned day ght or blue glass bulb for illumination, This saves many a headache and he objects viewen will reveal their true colors better and beharper FRANKLIN STEINBERGER.

Tire movement of large and heavy sheets of metal to and from punch press, rolls, and other machines is made much easier and faster by the use of a ball-bearing skidway like that illustrated. Two or more thick 2or 3-in, channels have holes punched in them at regular intervals and sockets welded to for



A shop shidway art with large ball bearings. on which heavy sheets of meta elide eastly

steel balls. Each ball is inserted through the hale, after which a small section of plate is welded over the hale. Weided hurses of pipe are used to support the channels. Short sections of larger channel stock are weided receives on the horses to receive the long bul-bearing channels.—Joseph C Covil

CELLULOID BUCKLES

(Continued from Jace 63)

scroll saw, and the cut me done with long light strokes. If a power saw is available. use the finest lig-saw blades and feed the material against at slowly, otherwise the best will melt the celluloid, cause stocking, and orrak the buile. Sowing at a 15-deg, angle gives an attractive beveled appearance to the work. (See Fig. 2)

The sheet celluloid is very easily engraved with any design by using a past, Grind and file the point V-shaped and hone it until sharp. Figure I shows the way to hold the graver to cutting out an in trail. If desired, the lines may be filled in with prepared was or even thick oil point such as artista use

Sundhapering and fling are necessary to even up the edges of the buckles. A velvet finish may be obtained by polishing with pumice stone and water. Whenever it is necessary to restore the massy finish as after sanding and firms and to remove scratches. flow acctone over the buckle with a clean brush This must be done quickly to avoid leaving brush marks (Fig. 5) Acetone, which is a solvent, is also useful for cement he two sheets of celluloid together to build up a thick buckle. Clamp the parts together untal dry, then flow the edges with acctone, which will concest the joint and make the two parts look like one

Tongues are made from short pieces of heavy (12 or figure annealed by wire This is easy bent to the recontrol shape. after which it is pounded partly flat with a hammer to temper the metal and give it the requisite hardness. An ode, way to finch the tongues is to dip them in a but solution of 20 grams of lead acetate, 50 grams hypo-(sodium hyposuphite), and 4 oz, of distilled water. As the temperature of the solution rises, the tongues will rapidly change to many colors, one at a time. They are removed when the des red color is visible. The metal will be found covered with a total fifm of the color. A test tube and Bunsen. burner are handy implements for this opera-

METAL SHEETS ROLL ON A Practical Workshop in One Motor-Driven Tool

New Low Priced "Delta" Drill Press Performs Six Different Operations Efficiently . . .

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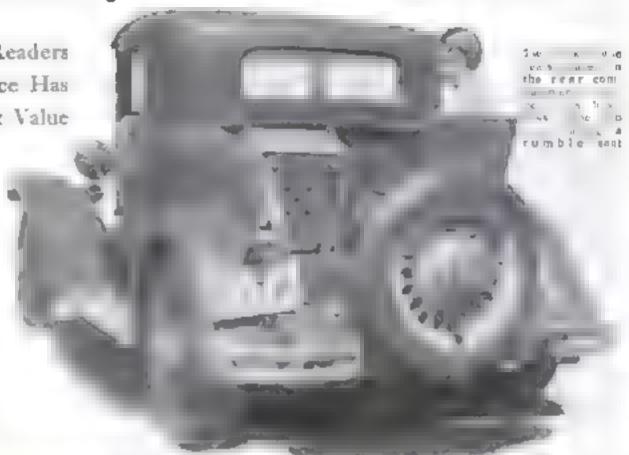
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ARRESTOR DE CARROL DE LA COMPANSION DE L

Useful Hints for Car Owners

Ideas Furnished by Our Readers Whose Practical Experience Has Demonstrated Their Great Value

Y INSTALLING two bucke sype seats. I recently converted the star compartment of my business coupe into an inexpensive, yet comfortable, rumbie scat. An automobile junk yard that harbored a disabled coach yielded the seats for a few dollars. After the lid to the rear compartment was removed by loosening two bosts. I placed the seats to allow plenty of leg room and boiled their hinged standards to the compartment door. When not in use the seats can be folded down and the lid replaced. If at any time I want to remove the seats ent rely, all I have to do it pull out the hinge pins in the standards,-R. G. A.





Curring the bottom of garage
donts on an angle,
as shown, will
heep are from
forming no they
or the Nate only
arid high in center

Sticking Garage Doors

IN THE winter, swinging garage doors often atick and freeze along their bottom edges. As a result, every bit of snow that accumulates on the driveway in front of the doors must be cleared away before the doors can be opened. You can make this less of a chore, however, by altering the construction of the doors and supplying an oak sill. Since it is generally the snow and ice on the driveway directly in front of the seam between the two doors that causes the trouble, cut the door bottoms at an angle as shown and install a triangular sill that will provide about four inches of center clearance.—J. D. G.

Oiling Cylinders

HERE is a simple device for quickly introducing any given quantity of oil into the upper cylinders of a new or reconditioned motor during the initial running-in period. It is made up from a small, mayonnaise jar, an oil can spoul, and a short pick-up tube having an inside diameter of approximately one sixteenthinch. After drilling a hole in the oil can spout near its larger end, solder one end of the pick-up tube threetly over the hole The pick up tube then is inserted in a hole in the screw top of the mayonnaise jar and a fillet of solder placed around it. to hold it in place. The screw cap also should be provided with a small vent hole. To use the injector, fill the jar with



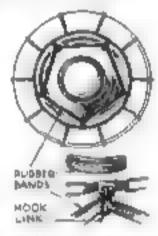


upper cylinder oil and with the motor running at a fairly high speed, hold the jar to the oil-can spout rests in the air intake of the carbureter idling jet. By placing a finger over the large end of the spout for short intervals, you can cause the motor suction to draw the oil up through the jet into the cylinder—R. J W

Tire-Chain Spreader

WITH the coming of ice and snow owners of many of the modern cars may find that the jumbo hubs gracing the new wheels make it impossible to fit spring spreaders to their tire chains. Being large in diameter, the disk hubs interfere with the spring links of the spreaders

However, spreadces that will fit can ae made from nurrow bands cut from & Worn-out inner tube. Five bands will be needed for each wheel The spreaders are hooked to the ade chain at equally spaced intervals by means of hooks made by opening the looped ends of cross-link fasteners taken from an ola chann.-H F.



Hobber bands cut from old bast tube serve as watermakes tra-abase spreaders

Leaking Grease Fittings

WHEN grease fittings become nicked and worn, they very often leak grease when the gun is applied. You can prevent this by placing one or two thicknesses of cheese cloth over the fitting before attaching the gun. The cloth will serve as gasket.—E. J. N.



A SIMPLE WAY TO LAY OUT LARGE ARCS

WHEN space is limited, it is difficult to by out a large are such as might be needed for a trellis or to form the arch for a window or door opening. This can be done, however, without finding the radius of the art and attempting to swing in the curve from the center of the circle

Suppose the arc is to be drawn between points A and A1, which are 33 in sport, and is to rise 51/2 in, at the highest point, B Place a piece of posteboard on a plank or



Two laths are fastened as shown by dorted lines, then moved in contact with the nails

other sunable surface, and drive brade at points A and A1, spacing them about 1/2 in from the edge of the pasteboard. Drive another bend at point B, Cut a 4-ft sath in the middle and plane one edge of both pieces. Place one piece with its planed edge against the brade at A and B. Set the other ngainst britd B and let it extend out strught as shown by the dotted lines-that is, parallel with the line or chord between A and A1. Where the second lath overlaps the first at point B, fasten them rigidly together with brads.

Place a pencil in the angle where the laths come together at B. Keep the laths in contact with brads A and B and slide them amouthly in the direction shown by the arrow. The pencil automatically will draw the desired arc. Repeat on the other side between hrads B and At. Cut the posteboard to this line and use it as a pattern to mark

the work,-C. A. K.

BLUEPRINT GIVES PLANS FOR BREMEN MODEL



Model of the liner Fremen 20 in. song, built by George C. Deany from our plans

FOR those readers who have built either of our two miniature ship models, the Manhaltan and the Indianapolis, and wish to try something a little larger yet not much more complicated, there is no better project than the ocean liner Bremes shown on our special blueprint No. 158A. This will be sept to any reader for 50 cents. Please use the roupon on page 64

The length as shown on the blueprint is 151/2 in., but two scales are given at the bottom of the shret for reducing the model to 10 in. long or tocreasing it to 20 km, if a smaller or a larger model is desired. The drawings were prepared by Donald W Clark, who has specialized for years in designing small whitled models

The Bremen model Mustrated, which is 20 in, long, was constructed from these plans by George C. Denny, of Washington, D. C.

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THE above pictures were snapped at the Century of Progress Exposition where Rudy Hofmeuster turned shapeless blocks of wood into accurate, realistic models of dinosaurs and other prehistoric animals in half an hour, by the clock! The figures take shape so swiftly, under his flying hands, that the eye can hardly follow his movements.

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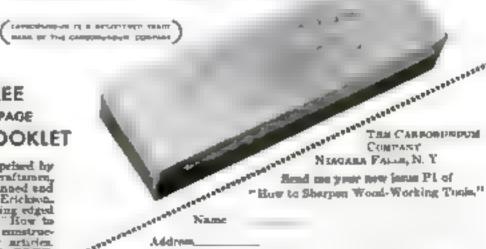
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Designed in American Empire Style

By Herman Hjorth

Andrea of the first of the first of the

1115 end table is quite different from the ordinary types, because it is an adaptation of the American Emoure period, which reached its greatest development in the designs of Duncan Phyle during the moeteenth century. While the structural and decorative features at first plance may seem rather difficult. It will be found on closer. exam nation that the work is not so much a matter of skall as of time and patience

The arst step in the construction is to glue up the stock for the sides. When the give is dry. the sides are planed and amnotheron both faces. They are then naded tem porarily together and the center lines mucked The nails should, of course, be driven in the part that is to be cut away. Saw the two at the same time either on a band law or with a band furning saw. Next saw the four \$5 in pieces to be glued to the outside

surfaces of the legs. The grain should run lengths up so that these pieces will strengthen the less. Smooth the edges of the 14-18 tucces, but do not amount the edges of the odes until later

Beginners in wood-

end subla with its

handy book trough to easier to build

then it looks to be

The two boards forming the book trough should now be cut, shaped, and planed to d mensions. It is important that both surfaces are planed, scraped, and sanded before the joints are marle. Lay out the book trough grooven on the inside surface of both the side pieces, making their winth equal to the thickness of the book-trough boards Chisel the grooves to a depth of by in, and finish them with a router plane. Fit the book trough and the sules together, and number the baggeds and the corresponding groover.

To complete the udes, four faith, boards are glued to them as shown on the orawing These boards are then plantst to Mar their haver enus are reduced to a theaness of , in The coxes of the sides are now fire

> sandpaper. The bends are then laid out and corved This can be done with a in paring thesel. First arve a small V-cut, then enlarge this and round off the sharp edges. Care must be taken always in fut in the direction of the krain The beads are finished with scrapers and sancpaper. A strip of wood is glued acrosthe grain of the sides at the

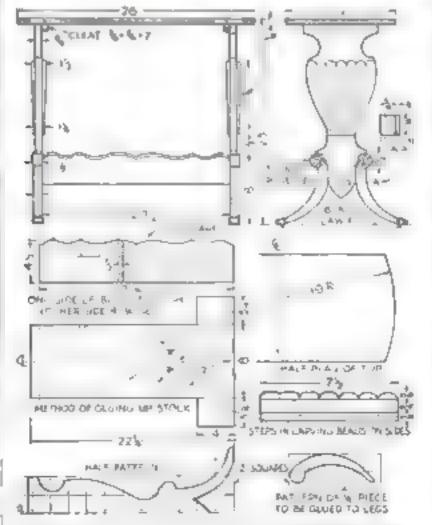
ished with file scraper, and

point where the beads term male The beads on the legs are made with a scratch stock This homemade tool was

described in the preceding article of this series tPSM. Dec 33, p. 80) The leas may be further decorates with resettes, either turned on the lathe or hought readymatic. Brass feet are also (nexpensive and add much to the appearance of

the table

The table is now ready for gluing. Use two bay clamps and two gluing blocks about g by 3 by 6 in. Clamp the table together without glue to test the fit of the various parts. Measure the distance between the somes at various points and ad ust the clamps until this distance is uni-



Side and end views, a half plan of top, patterns for book trough, sides, and leg overlays, and method of gluing up stock

form at all points. Place the table on a flat surface and correct any tendency to rock by planing off the underside of the legs. When all adjustments have been made, apply give in the grooves and on the ends of the book trough and clamp all together. Remove any surplus give before it barriers.

The top should be made from a board that is straight and beautifully figured. It is instened by means of cleats acrewed to the sidepieces. The edge of the top may also be headed as shown with a scratch stock

The finish of the table will depend some what on the kind of wood from which is has been made. A close-grained cabinet wood is preferable. If it is to be stained, a water

List of Materials

Si- Like	of Description	т.	W	1.
2	Sides		5	1.
4	Sides		5 .	4
4	hoses (to be besded)	41.	1/1	4 54
- 4	Stripe under beads	15	1	1 4
- 6	Leg overlays	15	31.	O.
1	Book trough	- 5	4	E .
1	Book trough	1/2	414	1.4
1	Top	核	1.2	- 6
- 2	Cirats	46	da	-
- 4	Resettes	54	114	11/2
4	Bruse chair feet			
17	Screwn, Rathred bruch	1 150	da. Na	. 9

stain is recommended because it is easy to apply gives a clear color and does not take Refore using a water stain the table should be washed off with clear water and allowed to dry. This treatment will rune the grain. The wood is then sanded again, and when the water stain is applied the surfaces will remain amounts.

NOTE: All dimensions are to in-key and are

finished spen

One of the enough and most substactory ways of finishing a wood sur are is to apply several coats of a good grade of shellac th need with alcohol to the consulency of water. Do not go over the surface with the brush more than once and pick up any runs immediately. Allow each coat to dry at least three hours and rub it smooth with No. 2/0 or 3/0 steel wool. The lourth coat may be subbed down with crude oil and No. 6/0 waterproof sandpaper. Powdered pumice stone may be used in place of the sandpaper. The beads should be rubbed with crude oil and a little pumice stone applied vigorously with a brush having short, close-set bristles.

REMOVING DUST FROM INSIDE OF CAMERA

The interior of a camera accumulates dust and fine particles of material that are likely to collect on the camera lens. This is particularly true in the case of a folding band camera when the bellows is opened and closed frequently, thus stirring up the dust To remove this material without a lot of bother, electrify a stick of common sealing wax by rubbing it with a piece of flannel. Insert the stick within the bellows and move it around. The foreign matter will be attracted to the stick, from which it can be easily wiped off Repeat the operation as often as necessary.—Eastt, J. Novak.

GAGING DEPTH OF DRILLS

There are many ways for paging the depth of a drilled hole, but the little stum I use is simplicity itself. I measure off on the drill the depth of the hole and wrap a piece of Iriction tape around the drill as a marker.—H. F. T



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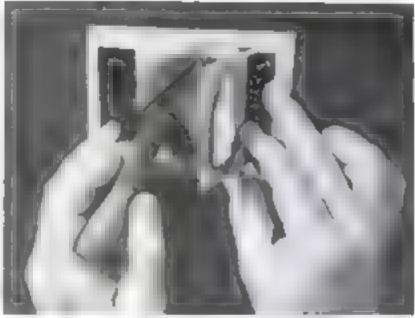
HINGED STENCIL LEAVES NO GAPS

formiliar with the ordinary single stencial (A), but few outside of professional tanks are ac quainted with the double stencial (B). The single stencial has tres or in cross between component ports of individual letters which produce a sporty appearance in the pointed word or design.

The double stencil eliminates these unsight by gaps. It is made in two operations. The parts are cut so that the holes forming the design over-lap or supplement each

other, thus eliminating the need of ties and screngthening the stenced. The double stenced is iteratest drawback has been the difficulty in obtaining accurate registration of the two parts. This is usually achieved by placing the second stenced over the design painted by the first so that it appeared to be "right," or by curring "key stors in the second stencil to fit over designated parts of the first.

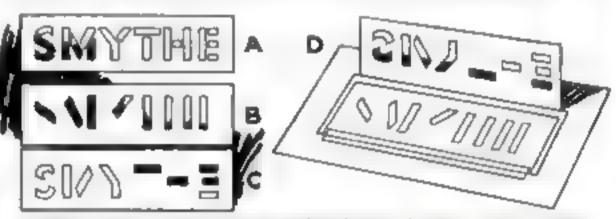
The hinged double stencil (D) avoids all the difficulties of obtaining accurate registration, but is practicable only with muck drying paints such as water colors temperal japan colors, printer a inks and lacquets, or with more slowly drying colors when applied on highly absorbent surfaces.



A tringed sten. In the figure four First one part then the other, is used, making a figure without and ghirly then

The stencil frame is made either of the same ma erial as the stencils or of a starder material of the same thickness. If the stencil components are of paper or four the hunge may be of gummed paper or adhesive tape which should be shellacked after appropriates to repel moisture. If metal stencils are used, they may be fastened to a metal frame with small hull hinges soldered in place. After the first stencil section is hinged to one side of the frame, the other section is placed in register and hinged to the other stor.

In operation one section is pairted in while the other remains foided back (D) then fold back the section—it A



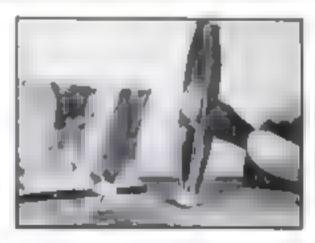
The ord nary type of single stenril with "ties" a shown at A the two parts of a double stence is appear at B and C and these are combined at D by hinging them to a suitable frame

TIN COVER SERVES AS TRAY FOR OIL CAN

Various holders are made to prever a small oil can from leaving only marks no the workbench. but one of the eas rest to obtam is a smooth compression can lid the inside of which is a lat larger than the bottom of the oil can. To prevent the can from stycking to it use a roundheaded bolt or screw to stamp the metal down in several places close to the rim and also in the center.-F B



An of can holder or tray made from a round to cover



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A SMALL size soft hammer for pounding out dents in this copper alaminum or other sheet metal can easily be made by inserting a rubber-headed nail in the slotted head of a magnet hammer as illustrated. When forced into the slot, the nail will be held firmly—R.] M



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Simple New Template Method Aids in

Laying Model Railway Track

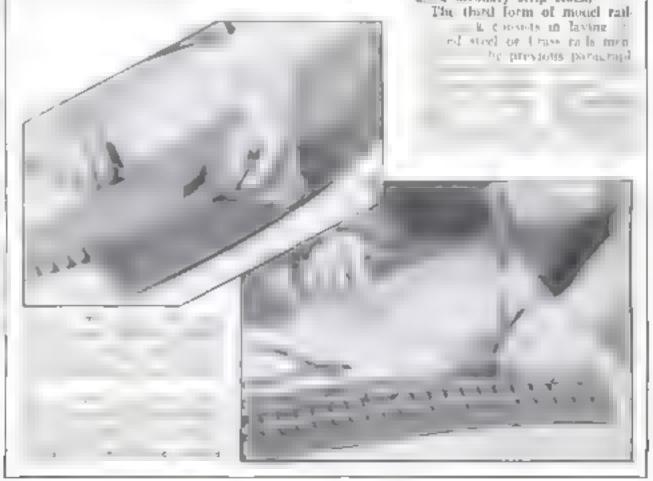
APOLEON once said that an army travels on its stomach. Paraphras ins Sapoleou, a model railway travels on its track, and that's only another way of saying that the success of a model railway depends largely on the perfection of its readbed

Of the three possible forms of track for model railroads, the simplest and most poten lar is the manufactured track made of the plated sheet steel. Any child can join stand and sections of such track and get a rate factory roadbed. Aside from the caution to handle the sections of track with care and to see that the connecting pins fit turbily, no

our process of Port LAN there have appeared a number o ways of cea mp w/b special problems such as the cutting of odd lengths (P. S. M., Jan. '29, 76, Dec. '31 p. 118, lov. '32, p. 72, Dec.

The second pupalile torm of model ra-

way track is what may be termed the com-pletely homemade type. This may by consults of steel or brass strip stock set into notches sawed into wooden crossties. Thirty years ago nearly all commercially built model railis sy track made in this country was of that type. It is remonably chesp to build, but involves considerable labor in slotting the ties a job which has to be done with great acturary. Joints between the rails are difficult to make and clumsy in appearance Today very little of this track is being laid because the price of steel rails formed like ntar ratiroad rush has dropped so low that there is no longer any great saving in using on mary strip stock,



than the slotted tie system. However, curtain short cuts remove most of the difficulties and make the work less tedious.

Figure 1 shows the latest way to lay track. First cut a piece of 54-in, plywood or pressed-wood board to a straightedge, or to a curve that corresponds in radius to the inside rad if for a curved portion of track. Next cut notches into the edge of the board to correspond with the width and spacing of the ties and in depth equal to the length of the protruding beyond the rail. It pays to take plenty of time and make these tracking by templates carefully and accurately

The first step in laying teach with this type of template is shown in Fig. 1. The base of the straight or round portion of track is first prepared (rots plywood covered with a strip of gravel-coated rounds paper, which is a good unstation of track ballast. Then the template is put in position, and the ties are dropped into the notches and nasked to the base with one small null in the center of each

The next step is to fasten the inner tail of the curve or the straight rail on the template side of the ties into place along the edge of the template with pairs of they nails, the heads of which hold down the edge of the track base

The third and last step is to spike the other rail into place, using track gages to hold it at the proper spacing while the job is done, as shown in Fig 2. Note that these track gages, which can be bought or more at home have three notches. The single notch should always be placed over the inner rail on curves.

The method described was used in the trackinging job illustrated at the beginning



Fig. 3. Third rail mounted on batchite inaulators connectors for third rail, shown at upper left); and speel conting rail with spring brass connectors (illustrated at lower right)

of this article. The layout is part of an E5ft system bulk for exhibition purposes. It was so large that it had to be set up temporarily in a loft

Assuming that the locomotives are electrically operated, as is the usual system for indoor tailroads these days, you will need some way to get current to and from the motor in the locomotive. There are three possible methods. You can boad an overhead wire system with pantagraphs on the incomotives to collect current from the wire. This method simplifies track construction but is a long-winded and delirate jub it you make the overhead wire-supporting towers best and even reasonably true to scale.

The second possibility is to insulate one wheel of each pair on every car and locomotive and then use the two running ruls, which are insulated from each other by the wooden ties, for your carrent supply. This methor was decarded by commercial manufacturers in this country many years ago.

The third method now in almost universal use, is to install a third rail either between the running rals or at one side of them. The latter method has the advantage that it simplifies track construction and is no more

work than putting the third rail in the center. Of course, side-projecting brushes from the locomotives are needed to make contact with the side third rail, but these can be made quite inconspicuous.

The cheapest way to lay a third rail, either between or outside the running rails, is to put a row of small flat-headed brass screws in the ties at regular intervals and solder a heavy brass wire or a thin, narrow strip of brass to the heads of the screws.

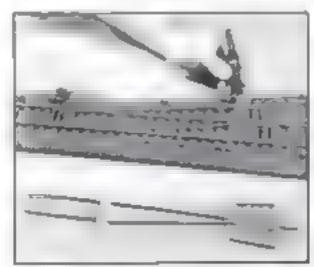


Fig. 4. An "O" gage unitch assembled from stock parts, and two easily fitted cantings

An easier but more costly way is to use the special third rail mounting insulators made of takebite which are now obtained the center takes a small rail used to hold them to the ties, and two tiny lips of brass modeled in the bakelite are bent around the lower flance of the special brass third rail.

Figure 4 shows a switch fitted with out side third rail using these insulators. It also illustrates two other items that are of interest to the model tracklayer analous to avoid some of the harder work. Below the switch you will see two castings of a new type designed to simplify making up a switch.

the queenen of rost naturally covers not the matter of how no which true of most railway track you will lay on your "right of way." The regular manufactured sheet steel track costs about seventy costs a yard. The cost of homemade track put together by the slotted-tie system is difficult to estimate because so many possible stress and kinds of material can be used. Model track of the type shown in Fig. 2, plus the third rail with all necessary fittings, including tress will rently about a dollar a yard for "0" stace

The "O" page steel running rails ordinarily cost about it are and one half cents a foot so that if you have a circular saw and access to a scrap fumber pile and can therefore ripyour own ties and if you will also make the third tail out of brass wire as described above, the total cost can be kept within forty cents a yard.—Titomas W. Auxoro.

HOW TO COPY HALF-BREADTH PLANS WITHOUT TRACING

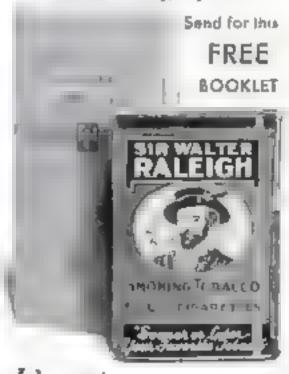
When only half of a design is given on a drawing (as is the case with ship mode halfbreadth plans) and it is desired to transfer the complete outline to a piece of wood, this can be done easily and accurately without less no us using two sheets of cartain paper Lay the back of one against the face of the other tole the two squarets to the milion carbon side out and place them under the draw or. To insure that the folded edge of the carbon paper comes exactly to the center line of the design, drive two pans on that one and push the carbon paper up to the pin-After the half outline has been transferred. you will have a complete design on the back of one of the carbon papers both sides a keand this can be used for transferring to the work James W DICKENSON

HOW TO BECOME A LION TAMER IN 3 SHORT PUFFS

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OILED RACK PROTECTS BITS FROM RUST

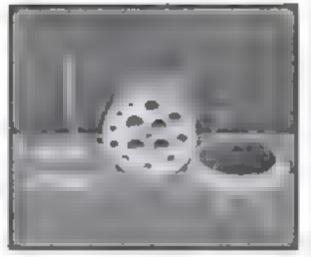
AUGER bits can be kept free from rust and protected from accidental damage by making a revolving rack like the one illustrated to hold them

Glue up a block of wood 51/2 in. square and 4 in. thick, mark a 5-in. circle, and band-saw closely to the line. (If a band

saw in not available, the rack may be left square and the revolving feature omitted.) Make base A 14 in thick and 414 in in diameter Part B which serves as n washer, is 1/2 m. thick and 13% in, in draweter. Bore # 36-in hole in the center of each and fit and glue a 36-in, dowet 7 in long in them, being sure the dowel stands vertically Make a cisk C 1/2 in thick and 6 in, in diameter and another disk D 14 in thick and 546 in in dameter. There cut out the inside of D, so as to leave a zing of wood 56 in

wide. This can be done by entering the hand saw at any point as indicated at E. Then glue and brad D to C as shown and hore a 7 to-in hole in the center of C.

Find the center of the top and bottom of the rack, and make a pasteboard pattern to show where the hole for each but should be bored. One accurate way to do this is to cut a disk of paper the size



The parts of the he'der. The bits rost on on outdidely dish which five within ring D.

of each bit, place each to best advantage on the cardboard, and mark each center with a prick point. Use this to mark the center on the top and bottom of the block so that corresponding pairs will match exactly. Bore each bole 1, 16 in larger than the bit it is to hold, and also bore a 7/16-in, bole in the center. In all cases bore partly through from one side; then bore from the other until the bit clears itself in the hole first bored.

Fit a piece of felt in ring D, make a 1/2-in, hole in the center of the felt, and hore four holes through C and D and corresponding holes in the rack as at P so that C and D can be fastened to the rack with 11/2-in. No. 10 screws. Then drop the rack over the dowel. If a drop or two of oil is put in each hole occasionally, the bits will remain bright and in good condition.—C. A. King.

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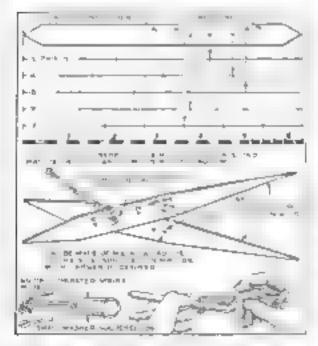
MAKING PROPORTIONAL DIVIDERS

The revolving such and

an assortment al bits

IF ONE S drafting kit does not include proportional dividers, an efficient substitute for this rather expensive instrument may be easily made by the method flustrated. The dividers will be found very useful for energing or reducing a drawing or sketch.

The blades may be made of cardboard brass, aluminum, or even thin wood. If



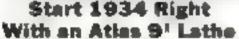
How to lay out hinden for proportional dit ders, and a quick acting apring wire pirot

of cardboard, cut the two blades to the shape shown in the upper diagram; if of stronger material, taper them as suggested in the larger perspective drawing. Then mark the blades as accurately as possible for the boles. The principle of laying these out is made clear by the divisions on the five lines drawn immediately below the pattern for the cardboard blades.

If, for example, it is desired to enlarge a drawing to exactly twice its size, the blades should be divided lengthwise into three parts and the hole made at one of the divisions so that, when the instrument is assembled, the distance from the pivoted joint to the one end will be exactly twice the distance from the joint to the other end. Similarly, to enlarge three times, the blades must be divided into lour parts and the pivot hole placed at a point one quarter the length of the blades from one end. Other divisions can be worked out in the same way. For small work a good length to make the blades is 6 k in , as indicated by the inch scale placed beneath the lines upon which the divisions have been marked

The pivot should be quickly removable for setting the blades. The wire design shown has given satisfaction and is not difficult to make.—J. D. G.

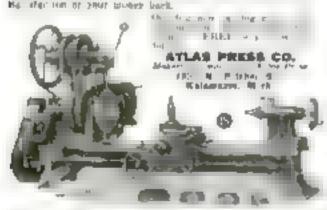






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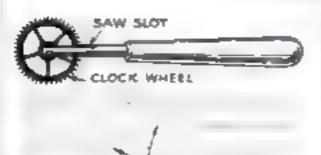
To the set of the set Harry Bosts A STANTED RESPECT OF TARRET TWO MACH IS AL





FARRAGUT'S FLAGSHIP HARTFORD

Continued from page 50.



Tool made from a wheel taken from a watch for mitating sails on the copper sheathing

IMITATION NAIL HEADS

deal. The forecastle has to be but on so we make a piece as shown at F and cut the inside of 1 to the given line. The after end is the thickness of the hulwarks and some wood should be left forward for outside shaving and gluing. This piece will be 1/2 in thick alt and 13/16 m. forward, and wall have a deck 3/32 in, thick, out to its edges This deck is not yet put in position

From pieces of J. 16-in hardwood, cut the stem and beak, sternpost, and keel. Give and nail or rabbet these to the bull. Note that the keel extends to the sudder trunk. The midder trunk is fastened to the keel with a scarfed (notched) joint and set into a hole ia the counter

The bulwarks are really of made and outside planking fastened to the timberbeads. but as none of this shows I made more of strips of semihardwood 3/16 in thick. The shape can be obtained by pinning a piece of cardinard outside the hull and marking the deck level. They are \$6 in deep from end to end. If the ports are cut out beforehand. which is really better than to cut them afterwards as I did, make the cuts from the top edge to within 3/16 in. of the bottom. Then they can be glued on the edge of the dock and nailed through the port sills. Be careful that the udes of the ports are upright when in position

The ports in the bow are closed, as only V-cuts are necessary to indicate them Round pieces are glued on to represent bucklers (plays). Because of the curvature of the bow, the ports appear to stant, but in reality they are upright and the same nor as the others. The stern ports were med as windows, so should be cut in about 1/4 in, and have windows set in them. The windows are pieces of clear celluloid glued on a dark blue backing, with white sashes ruled on. These details will be illustrated with additions drawings and photographs in a following in-tailment.

The quarter galleries, containing the admiral's and captain's bathrooms, can be made a sould believe to see house. Sought work a piece 34 in. thick, cut it to the outline given at B on the sheer plan, then cut the inside to bt the hull. I filed to underneath with a little plastic material. Cut the vertical part to the depth of the gun port, and make a curve above to the edge of the deck and two flat places beneath. For the moldings I used than stripe of sphne (cane)

Before leaving you until next month, a word regarding the parating will be in co der. If the hull up to the water line is to be sheathed in real copper, this should be some first. Shim copper about 2001 in thick is the most suitable and can be gloed on. I made mine in three strips of about equal widths at the ends. Before gluing them on, I marked from the buck the edges of the plates with a little wheel made as shown from a watch sprocket with the treth filed a bit sharper This tool gives the appearance of nail heads. The full-size plates are 14 to by 4 ft. If copper is not used, that part of

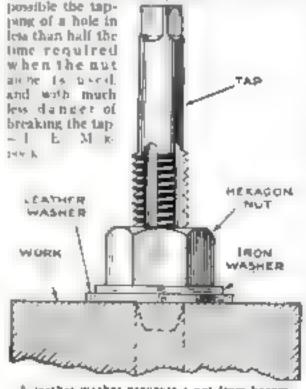
the hall should be painted copper color and some green should be added to indicate verdigris. Real verdigris can be formed on genune copper with strong vinegar to which a punch of salt and a little ammonia have been added. Soak a cloth in this, lay it on and wave it overnight. When dry, brush off the superfluous green and use steel wool to polish the copper a little at the bends. I did this and then applied a coat of this, clear lacquer to keep it in that condition

Above the copper the hall is black, except from the edge of the deck to the top of the gun ports, which is white. The Hartford has been painted differently at different times. She has usually been all black, but at one time was a light lead color. There is one photograph of her in 1862 with the white stripe, which is, I think, the best looking

The decks should be scribed with fine black lines, say 1/10 in, apart, to represent the edges of the deck plants. I use a 4-H pencil for thus. The decks are then given a coat of this varnish, but this must not be shiny, (To BE CONTINUED)

NUTS AND WASHERS SERVE AS GUIDE FOR TAP

IT IS deficult to tap a hole by hand so that the threads will be square with the face of be work no matter how true the hole ly drilled. Some mechanics who happen to know the kink make a practice of facing the hottom of a nut and screwing it on the tap, Then they gradually turn the nut up as the tap goes down. Unfortunately the tendency of the nut is to lock the tap so that the process is slowed down. This difficulty can be completely remedied, however, by the simple expedient of placing a flat fron washer against the bottom of the nut, after it has been screwed on the tap, and then adding a second washer of shoe leather. The la ter, which comes in contact with the work, is no clastic that it keeps the tap from being locked by the nut, while the intervening iron washer prevents the nut from tearing the leather With this assembly the not can be screwed down tight enough to keep the tap vertical, but will not lock the tap, therefore it makes



A leather washer provents a not from becoming locked when used up a guide for tapping

NOTE. Coptain McCaun's series of general articles on this model construction (P. S. M., Sept '33, p 60, Oct p. 68 and Nov. p. 66, will be returned when the new Hartford arries is well under way



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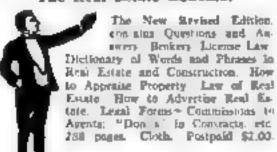
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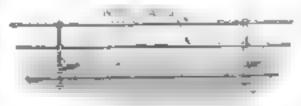


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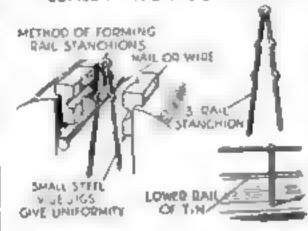
The Popular Science Bouthly

SHIP MODEL STANCHIONS FROM COTTER PINS

SPRING cotter pins, which can be obdiameters, make excellent stanchions for model boot rails. A piece of wire of suitable gage is run through the open end of each cotter pin. If two rails are wanted, a thin strip of tin may be used to represent the lower rail; this is placed about halfway down in the split between the two legs of the notter pins. With a little more work, a wire instead of a flat strip can be used for the second call .- Router Forces.



COTTED DIN THO-DAIL STANCHIONS



Stationals for the ralls of thip models may be made from very this spring cutter pine

HOMEWORKSHOP GUILD

(Continued from page 65)

visited Rockford to familiarize themselves with the work of the Guild and they have given their time generously in ambling in the preparation of the Guild's literature. The magazine has also borne the cost, of preparing and mailing many thousands of letters and bulletins from its New York offices in order to spare the Cauld officers as much clerical work as possible. Furthermore, the publishers are providing a free subscription for the secretary of every local club affiliated with the Guild. All this has been done without cost to the Guild

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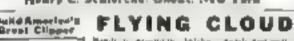






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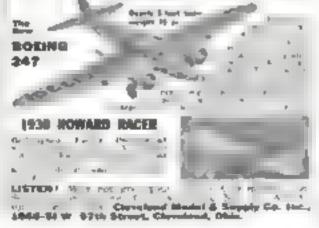
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AIRPLANES KEPT FLYING BY GROUND CREWS

(Consumed from page 24)

the inspection just described is called a tenhour inspection it is given the air liners after each flight. After twenty-five flying hours there is another inspection that includes an the items in the ten-hour inspection and, in addition, such operations as checking the branker ponts in the ignition system and checking all valves and other working parts

AT THE end of urity flying hours there is another and even more rigid inspection, and after 100 hours of flying, the ale liner receives a going over as thorough and as severe as is the annual inspection given all licensed planes by the Department of Commerce

Atter 350 hours of dying service, the engines are removed from the plane and sent to the shop for a complete overhaul. New motors are installed in the ship. The old engines are taken apart, all wors parts replaced, and then reassembled. After running satisfactorily (or or eacht hours on test blocks, they are resaced in a plane and given a thirty-minute - et flight. If they prove satisfactory, they are put back in active service

After 300 hours of flying service, the instrument board also is taken from the ship and a new one installed. The air board is sent to the shop for thorough testing, and for any repairs to the instruments that may be necessary

After about 2,000 hours of flying, the air finers themselves are sent to the shop for an rhaul that is practically a rebuilding. The wings, fuscage, and tall surfaces are stripped

of all covering and the frames examined with extreme care. New parts are installed whenever they are needed. Every detail of reconstruction must be approved by an inspector here the slip comes out of the overhaul ship, engines are Installed in it, and it is flown by several test priots. It then is turned over to the Department of Commerce for testing. It approved it to returned to pervice

The air liner of today doesn't spend nearly so much of its late in the shop as did the passeneer place a few years ago. Monorn smil a fied plane design has made inspection, maintenance, and repair the first asset

The preschaft transport line operators at does not tell now and their air bers done as sel efficiently, but they aren't or any of a massing them last a long time

MORNING had come, Overnight planes from the West and the South reares cown on the landing field and taxted mosily to their terminals. Passengers got out and hurned aboard the New York burys

In he name at he is true of Jutche I the tail of or e to be buys Comment and Long and discourse Name of the most and are are son the three motors were rost no and his three propeders whirbug. Then a in the fractor took thatge again, and the spin and span air liner was towed to its starting place Mail and bancour were placed aboard. Pag-

sengers, morning papers under their armtrolled out to the plane and entered its cabin Pilot and co-pilet nally in their blue uniforms n. 'n ha me entered the control n The condition persons The study dropped his flag. They no errolled smooth v down the runway turned onto the field. -- ip. ped for a few moments while its engine it week even more lowily then dashed across the field and leaped smoothly into the air.

Just another ulrplane taking off. But I had were some of the planning and effort and learnwork that are necessary to keep the air firers fiving, and realized for the first time that an air transport line, like a cadroad, is only a good as its maintenance department

How to Keep a Disk Harrow in Repair

By L. M. ROEHL

New York State College of Agraculture



While one man boids the grinder and braces at with his know the other turns the dealer

WillLE reporting a disk barrow, it is necessary that a gang of disks be raised free of the ground or floor so that the game may be rotated. A pair of low sawbories or stands suitable for this and other farm machinery repair work may be made as shown in the drawing on the following page from an 8-ft. length of "2 by 4" and a board L by 4 by 18 to

If the gamm must be removed from the homes to replace, clean, or repair the boxes, it is necessary to nall cleans to the top edges of the stands, both front and back of the shaft to hold the gang in place while being rotater.

Usually the boxes require cleaning or replacing. If the nuts on the bolts which hold the boxes are thated on so that they cannot he removed, they may be split with a cold chisel and then replaced with new ones. Nerr the diet has been compactely accupied and arushed from the bearings, oil holes, and oil tubes, they may be parked in hard stream or reassembled and lubricated with oil. The top end of the oil tubes should be expeed to prevent dict from reaching the bearings.

Disks frequently become bent at the rim-They may be atraightened with a sleege and hammer as shown in one of the photographs.

A pang of disks is too heavy to hold up against a grinder, so the grinder is unbolted from the bench or stand and beld against the disks. If the gritteler at hand is rather heavy to hold for any length of time, it can be suspended by using small pieces of rope



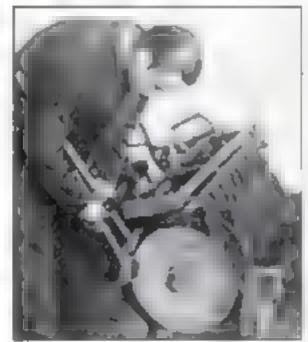
All irregularities are ground off the inside edges of the dask with the side of the wheel

and an old automobile tube. The latter permils the position of the machine to be regulated up or down or at any angle required

A 1 by n in grinding wheel is a desirable size for the work. The granding wheel at the other end of the grinder shaft should be re-Beved

Two men are required for the work-one to hold the attnder and the other to turn the gang of disks. A pair of leather or canvas gloves will protect the hands of the one who rotates the disks

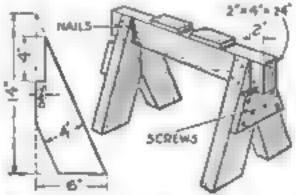
While the disks are being turned in the opposite direction to that of the grinder, the



When a disk is bent at the rim, it can be pereightened between a pledge and a bainmar

suk of the grander where is hold variable to the need of to of the discated all progalarmes.

The nutside edges of the disks are then ground to the desired shape and edge by holding the face of the grander against the disks at the required angle. The workman needs to support the grittler against his knee to make the work uniform. Anyone who is not experienced at this work should be excess) not to mend the edges of the daks so that as to weaken them. Notice how the edges of new disks are ground.



How to make low newhorses or stands to sid in topouring bayrows and other farm machines.

WIRE RIGGING FOR MODELS

FIXE copper or beass wire used for tigging airplane and ship models is usually so stiff. that it is almost impossible to draw it tight without leaving some small kinks. This difficulty can be eliminated by passing a strong enough electric current through the wise to make it red bot and thus soften it or draw it through a flame. LACK CUNYINGHAM



cope with the abnorma ly severe conditions of the

Antarctic. In this desolate, snow-swept country, thousands of muce from civilizate nutbese tools will be subjected to constant use to irovide she ters against raging bluzereds and subeven wrather, for countless emergency jobs, and to make important repairs. Because of their uniasua. Strong words constructions, plus their mechanical efficiency and great willmy, DRIVER Tools were preferred above other power tools, and are now aboard the Jacob Rapport, Byrd's flasship, en route to

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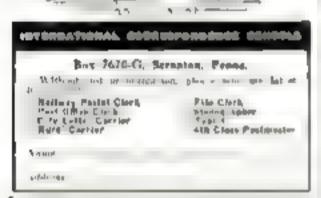
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OUTPOSTS OF SCIENCE STUDY CYCLONES IN THE SUN

(Continued from page 15)

to far corners of the rarth searching for cloudless skies. It has carried them across deadly deserts, through tropical jungles, among ic. covered trans. It has led them on a seemingly on in Orace, always seeking answers to the same to the oracle of

What is the rhythm of the minute chances in the heat of the sun and exactly how do these variations affect our wrather?

For De Abbot, the search for the answerhas been a bie work. Since the death a Langley, in 1906, he has been active head of the investigations. In 1911 and 1912, he went to Algeria, in nowhern Africa to make observations in the clear dry are of the Sahara and compare them with records obtained at the same time on Mt. W box.

IN 1018, the first permanent observation post outside the United States was set up at Calona, Chile. Two years later, because of smoke from nearby copper mines, it was moved to its present site on Montezama.

This Montecome station is one of the strangest observationes on earth. It has no telescopes. All work is done early in the morning. At night, when other watchers of the sky are busy, the men are resulting listening to the radio or playing two-handed planethle to while away the house. The delicate contrament of he raisets at a large all ender, the desired as a large all enders, the deadly Atacama Desert of Chile. In the cavern, the temperature chances field from day to day or from season to season

To learn the real strength of the sun's motiation, it is necessary to measure the heat of each of the rays of color that make up a sunheam. To do this, the Smithsonian related how any entire the upon and dustin ments used in the Monterums tunnel.

At he mouth a is the nm as a coeleter the state of the broken up into the dark interior where it is broken up into its many tays by a spectroscope. The heat of each tay is then measured separately by a bolometer and recorded automatically on a photographic plate by a malyanometer it takes about seven minutes to work through the solar spectrum in this manner and thus measure the sun's radiation. This is done several times each morning.

While one observer is how locate the tunnel at this work, his mate is equally busy outside making it series of observations the the suns abstracts the other in the base of the rays from the sky near the sun to be these observations must be accurately made

The work of observing, which is typical of the extra term of the state of the extra term of the state of the extra term of the state of the state of the extra term of the state of

HIRE, it is compared with the data coming in from the other two permanent stations maintained by the Institution, One of these is on Table Mountain, on the edge of the Mojave Desert, the other on Gehil Zetar the bare cone of rock that rises from the formulable Strait Peninsula of Egypt Few places on the surface of the globe are more remote from civilization than this mountain peak in the land of the Bedounts. Only the influence of an isolated monastery, which has been in continuous operation for fifteen centuries, makes it possible for the two Americans to carry on their Work in a rough stone observatory at the top of the peak unmolested by the Bedouing.

Here, as on Mt Montezums and Table Mountain, the weather is an almost unbroken sequence of coudless skies and hiszma suns. The search for such clear atmosphere, vital to the tests, has carried Smithsonian men tens of thousands of miles to and (ro across the surface of the earth.

In 1920, with the financial support of John A. Roebbng, a station was established on Mt. Harqua Hala, a 5.500-foot peak fitteen trates from the nearest town in Arizona In an adobe house on the crest of this pullated mountain, observers fixed and worked for five years until the American station was moved to its site on Table Mountain.

IN 1923. Dr. Abbot began combing the earth for an ideal spot, the best possible sits for a sular observatory. Algeria Balusha an A. austro arrange authorish names on the map of the world—were the serie the non-a tions. On the borders of local in Russ tan, he found a peak that seemed usual Bull It had the serious drawback that a constant armed guard would have be map to near the project the idearvers from the turbulent natives of the district

Then he tried southwest Africa. On a Hottentot reservation, sixty usles from the treatest town, he picked a site on Mt Brukkaros. It is a 5,700-foot peak of seamed and split rork, its obles strewn with Jagged fragments. Near the summit, an observatory tunnel was due in the rock, a rottage was built for the observers, and a teleshone line was run to the radical, there makes away. Daily observations were started late in 1926 and continued, weather permitting, for almost five years. Because of hazness at certain seasons, Mt. Brukkaros and not prove entirely entirectory, and in 1931, the station was discumited and its equipment moved to Getsi Zebic, its present location.

This triangle of observatories, Table Mountain in North America, Mt. Monterams in South America, and Gebil Zeble in
Airica, now supply the data upon which
weather casculations of the future may be
fasted. Only by poline up records day after
day, building a solid aroundwork of statusties, can then achieve this end. So the selentists have carried on in their monotonous,
dreary work for from civilization.

Their investigations have given a con, naous series of solar-radia ion measurements extending from 1918 to the present and a history of the association between these chances in the sun and shifts in the weather. Their work has covered the day-to-day chances to the intensity of the rays as well as the periodic fluctuations in the sun's beat due to sun spots.

These curious alorric cyclones on the face of the sun increase its activity in much the same way as poking the coals increases the activity of a fire. The result is always increased solar radiation. On the day when a new sun spot appears, the solar constant value increases. When the rotation of the sun carries the spots across its disk, the solar-rousiant value declines. The average of sitar radiation, the researches have disclosed, is 1.940 calories per square tentimeter per minute. For the period between 1912 and 1970, when there (Cantinued on page 91)

OUTPOSTS OF SCIENCE STUDY CYCLONES IN THE SUN

(Continued from page 90)

were an unusually large number of spot the average rose to 1,946.

The surface temperature of the sun is nearly 11,000 degrees F., twice as bot as an electric arc, the hottest thing we know on earth. But for the best supplied by this solar furnace, 93,000,000 miles away in space, our planet would be an ice-hound sphere, Although only one two-la.bonth of the total heat radiated by the sun teaches the earth, that heat, if it could be put to work would develop 200,000,000,000 horsepower'

I RING one of the early experiments on Mount Wilson, Dr Abbot did put some of it to work cooking the meab for his party He hadt an incenious solar cunker in which a cylindrical reflector of burnished aluminum caught the sun's rays and heated oil in a the camp took boiled water, baked bread and cooked ment without ever starting a fire. Within fifty years, Dr. Abbot believes, the problem of harnessing the power of the burder od . "he nuk

However, it is the relationship between the sun and changes in the weather that most arouses his interest. Already, the data that have been assembled have begun to take shape and forecasts made with them as

a basis have given promising results.
The former chief forecaster of the Argen line weather service, H H. Clayton, for example began several years ago using the Mt Montegums solar-radiation figures as he basis (or a weekly prediction of temperntare and rainfull for the city of Buenos A rea. Has forecas a were so a occession that contractors and other harn beaten business men whose affairs are affected by the qualities expressed the consiction that they had read duright and cents value

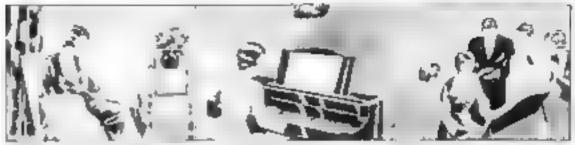
At present, Cast a is using data from Monterums and other stations, which are telegraphed such day from Washington to his home in Massachusetts, to forecast weather conditions in the vicinity of New York City

Dr. Abbot has found that variations of fees than one half of one per cent in the waxing and waning intensity of the sun have an important bearing upon the world's weather. However, the modifying influence of mounts us, oceans, winds, and vegetation play a part that must be given serious study before the new system is perfected.

BUT progress is continually being made. One recent discovery of the highest importance is that while the monthly average of the sun's radiation is apparently irregular in its variation, it really is composed of five cycles of eacht eleven, twenty five, forty five, and sixty-eight months each. This discovery made by Dr. Abbot marks a lone step Jurward in forecasting the intensity of the sums radiation at any future time.

In November, 1930, when the sun's radiation for several years had been below aver age, Dr Abbot used it as a basis for prefactors the average monthly radiation to the end of 1937. He stated it would be continuously above normal and that it would rise to the greatest heights observed since 1921. This forecast was remarkably close to the record of rater observations. On the average, he was only three tenths of one percent from being dead right.

The accumulation of data, year after year. has been a long slow laborious task. But now the scientists who have devoted their time to this work feel their roal is in sucht!



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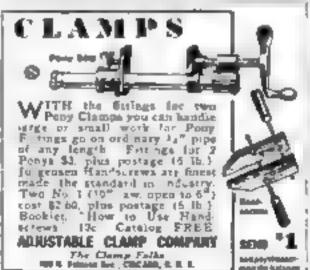
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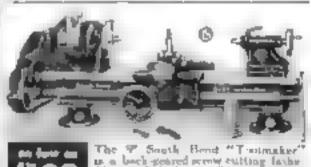
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MICROSCOPES FIGHT POISONED FOOD

(Continued from page 13)

enm meaning to the men who unravel Uncle Sam's mysteries with microscopes. There is an albeit traine in cigarettes which contain, not tobacco, but cansaba, the dued flowers of the East Indian becop plant whose fibers are made into rope. The citarettes have been found in the possession of soldiers of the regular army Campable is not defined at a narcotic but its action is very much the same, and equally as deadly as many common, posonous drugs. Indiscriminate smok ing of it causes hallucinations and even tually leads to softering of the brain.

So when government inspectors or other officials come upon cigarettes that look suspictory. they send samples to Washington kishan or Howard, by peering at the fill me material through a microscope, can tell quickly whether or not it is the brain-soften-

me flower of the bemp plant

The microanalyst has to be a crystal expert. Many drum, chemicals, and even plant tissues are in the form of crystals too tiny to be seen with the unacted eye. Aspirits found in many medical preparations, has a beautiful grystalling form. So do hundreds of other compounds. The crystals are different for every substance, so that they can be used for positive identification of h

4 bottle of capsules containing a reducive comes to the laboratory. The capsules are surexten of committing it substance that it be ing used at so amon of the food and drug law them as have been unable to ident a need year top not all materials viets to themical analysis. Inder the microscope the medicine is resolved into a mixture of drugs One by one they are identified, and found to be permusible. There remains one, it is in the form of beautiful crystals that look ake tiny jewels.

By direct observation, the microanalyst is not able to sdentify the substance It looks very much like a specimen in one of the bottles of known substances on fik in the calanet of drawers at one end of the room, but he is not sure it is identical. The specimen label contains information about the releastive moves the atobie to bend light raveof the material in he buttle So the analyst puts some of the questionable crystals on a interescope slide, adds 4 drop of a special oil covers it with a thin glass slip, and places it about the microscope. The optical proper tic of the crystal are measured. The questionable drug matches the sample exactly, proving that it is a harmful ingredient of

By using the optical crystallographic immersion method at the process just outlined is called, the microscopist can perform seem one maracles, and often can find the answer where other methods fail. He can determine whether a drug is of uniform quality or is a mixture of substances. He can ferret out

adulterants of diluents

An interesting and particularly beautiful branch of the crystallographic method is the testing for alkalouds. An alkaleid is an organic substance which has some of the properties of an alkali. Caffrin, occurring in cuffee, is an example. Many of the most deadly posons are atkalouds so their presence in f and drugs becomes a matter of great im-

A standard test for alkaloids consists of adding some chemical such as notassium (et ricyanide or give thouse and then inspect me the microscopic cristals which form These cry dass often are of rreat beaut looking like fantastic snowflakes or fairs ians. One of the most carefully guarded cupbeards in one of the Food and Drug Administration laboratories contains a collection of alkaloids, all (Continued on page 92)



MICROSCOPE

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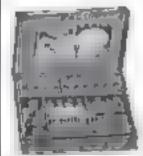
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MICROSCOPES FIGHT POISONED FOOD

(Continued from page 92)

deadly poisons. They are used for comparison with materials being tested, either microscopscally or by determining their reactions out animal Listue

OVERNMENT inspectors keep constant G watch over canneries to make sure that the food being prepared for market will be up to standard. In connection with this, food samples obtained at stores are analyzed. One of the common indications of meanitary conditions is the presence of one or more of the various kinds of molds. The microscope is the instrument for detecting the presence of molds, and then determining whether they are present in a quantity sufficient to make the material unfit for food

The "what is it?" part of the mold situation is answered in short order by direct observation, because all of the mitroscope evperts of the Food and Drug Administration learned long ago to recognize many common trouds at sight, and call them by their full names. The "how much?" part of the question is answered by placing material being examined into a depression in a glass slide, and then counting the number of filaments The shallow, circular well in the shde is of known depth and diameter, so that compurison with a standard mold count is easy A magnification of 100 or so diameters generally is used.

Insects enter into the perfore in many ways. A product containing larvae is found, for example. The larvae are identified as being from the vinegar fly. With this evidence the food experts can reconstruct the story behind the sample, and perhaps locate as insunitary condition at the source. The vineear fly, they know, pays little attention to fruits or vegetables that are in good condition, or are only shightly overripe. It is only when decay has set in and proceeded to a point where fermentation has begun and yeast plants are present that the fly be comes interested. The finding of the larvae of this By in a product usually means one thing: the raw materials have not been propcrly handled after harvesting

BY EXAMINING other fruits such as black-berries, respheries, and strawberries, microscope experts can tell much about their conditions before packing. The wold-countng method is used in checking berries Presence of mold in quantities indicates poor

Fig paste comes up for examination at istervals. The macroscope in turned on it mainly to determine whether insects have been involved in its preparation. Buts of wings, compound eyes, lees, and other insect. parts show that something is wrong. Often the insects can be identified. It is by keeping careful watch over fie paste that Uncle Sam makes sure that you do not eat insects in your cookies

Similar control is exercised over the quality of dried fruits, such us prupes, apricots, peaches, figs, raisins, and dried therries. Prunes are susceptible to brown not Peaches and aprocots may contain rotten or insect-fufested material which is carried through into the finished food product. Dried cherries sometimes are infested with a mold that is difficult to discover

And so it roes. The microanalytical laboratory at the Food and Drug Administration headquarters is never a dull place. Hardly a day goes by without a new kind of myntery to solve. And that, according to the men who are accustomed to working miracles with lenses, maker life interesting for them-and safe for you and about 110,000,-000 other people



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HIS FOLDING CAMERA PAID BIG PROFITS



TOHY MILDAU-ER, thirty-six years of age. found himself in a very serious bosition when his comany declared itself bonkrupt about a half year ngo. For several months, John went from firm to DEFIN 10 5 50 6 25

t must be get work of any work -and then as last the reatized that if he were to same wrt b - wife and two children, it would have to be by his own ingeniaty

Luckity or wisely enough, for years John Mildauer had faithfully pursued his pet hobby, photography. For many years he had obtained tremendous enjoyment out of taking pictures with his large postcard use folding camera. Gradually this bubby had led him into other assessment firlds. He had become fairly protects in the technique of developing and printing his own films. Now that this holdry of his was to come to the rescue he could be thankful that his preliminary training n these matters was all that it should be

One bit of human psychology was added to his recipe, and John was really to begin work. He realized that nothing w closer to the heart than HOME! Therefore, in a few words, John's purpose was to find a neighborhood where the people were wealthy enough to own their own bomes—but not so weathy that they had actual managers

After finding the neighborhood, John a business was simple enough. The bomes that looked attractive and were well-kept were his meat. Quetly, he snapped a view of each of the attractive housesand as quietly returned bome. In no 44 did be speak to the owner of the tioner. Immediately on returning bome John developed and printed the films bed emosed. He was now ready for the est stage of his job

RETURNING to the homes of which he had taken pictures, he apoke to the owners. In each case, he had the pirtures already made and ready. John found it a relatively simple matter to convince his potrons to have the picture transferred to the front of a half-dozen or dozen postcards'

The idea seemed to click 100% Everyone seemed delighted to know that the could send out postcards which way, I carry views of their bouses on the picture side. When John approached the local postcard company he found them equally enthusiastic. It was an unexpected source of revenue for them, and they could transfer the pictures at a very slight cost to limit. (Continued on page 95)

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Additional

Secrets of Success

HIS FOLDING CAMERA PAID BIG PROFITS

(Continued from page 94,

John 5 business has now reached amazing proportions. He is out in the air at day-and has made between afty and seventy-five do lars each week'

As John speaks of it, "Anyone can do it. People are always proud of their own homes-and love to show it to others. What better method than the postcard? The rates are twenty cents each for a half dozen order and fifteen cents apieco for orders of a dozen or more The rates are four-the profits fairer! What more can one ask?-W. H., Cleveland, Ohio.

TRAINING IS KEYNOTE OF THIS MAN'S SUCCESS

■ N these days and times it is refreshirut, to say the least, to find someone who is accoally corrying on in the good old tried and true way of payng strict alteration to business. Herbert Smith of Hawthorne California is



it I all a Hi sides not talk depression. and he a arways keeping an eye open to a varietyment in his chosen work.

Why not? you ask "He has a good job and, roll dy no worries." But that isn't the whole truth. The first path to his success was far from an easy one One of his greatest youthful ambitions was to go to college. It seemed the only way to the career he so strongly desized. But the untimety death of his a her put an end to those aspirations. and like many another young man be entered the world of affairs as a workman, but a codege graduate

Looking around for the kind of a job hat would lead to his ultimate goalelectric engineering-he secured work in a power house at Redondo Beach. Cab. forma. After three years, he began to realize how much be lacked in the way of a rounded experience. He left the job to ship on an "otter" on a freighter plying between ports in the far East. Any min who has ever gone to sea will fell you this is work-and then some

While thus employed, he decided that the next step in his career would come through education and not mere work. He took up a correspondence course in electrical engineering. That was back in 1427 the year which marked the out s anging milestone in his business life

Soon after this Herbert Smith went to work for the Standard Oil Company, and (Continued on page 96)

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Secrets of Success

TRAINING IS KEYNOTE OF THIS MAN'S SUCCESS

(Continued from page 95)

was promoted to fourth assistant engineer on one of the oil-boats. Then, in preparation for greater things to come, he switched his correspondence course to one in steamelectric training. Next we find him transferred from the oil-boats to the big retinery of the Standard Oil Company at El begundo, California, where he was put in charge of the Knowles cake ovens, the just ion which he is now hording.

The importance of this work is best restricted by one who has visited this plant. It is one of the Logest refinences operated by the Standard the Company

You prepared vourseit back in 1922 when America was sitting on top of the world. Isn't such preparation more nece-sary today than ever before, Mr. Smith was asked. He was not long in answering, "Yes." Smith said time is really here when training and apple at on anote will count at an Money spent in training today is a double investment for tomorrow

That isn't theory Herbert Smith Is still preparing. "I have practically finshed my Steam-Electric Course and now I in hard at work on mechanical draftsa maker in other words, I'm still prearing for the future

Cash Prizes

THIS department will give \$5.00 for every true success story submitted by readers of Popmar Science Monthly, and which is accepted for printing in this magazine.

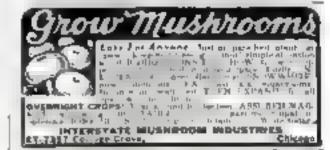
Manuscripts will be judged on the individual merits of the case and circumstances involved. Only stories in which the author's success, or that of some one known to the author, has been gained by some method of educational guidance, fitness for the job, or application to the work will be considered. We are not looking for the "get-rich-quick" type of story

Manuscripts must be confined to 500 words or less. They must be true and, if accepted, authors must be prepared to give us signed statements to the effect that they are true. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless postage is provided for this purpose. Address contributions to Success Story Department, Popular Science Monthly, 381 4th Avenue, New York City.





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HOW ASTRONOMERS FIND STAR DISTANCES

(Continued from page 35)

little ashesive tape. On a clear evening shortly before full moon, select a window through which the moon can be seen as hour or two after it rises. Then stick two strips of adhesive tape horizontally upon the glass about an inch and a quarter apart

If you have a window with old-fashioned movable slat shutters, you can close one and use the space between two adjacent slata instead of the tapes on the window pane. Finully, place a pile of several books on the corner of a movable table and you are reads tor the observation.

THE idea is to look at the moon between the tapes, move backward until the moon's image just exactly fills the space be tween them, and then measure accurately the distance of your eye from the tapes. The corner of the top book on the pile, brought tiose to the eye, will help in fixing the point where the eye-ball was when the moon ex-

artly filled the space When this point is ascertained, measure carefully the exact distance from the book corner where your eye was to the tapes on the pane. Also verify painstakingly the exact width of the space between the tapes Then you can calculate the diameter of the moon les a simple proportion in arribmetic

The only beare you must take on trust is the moon's distance from the earth roughly 239 000 m les. The ther measurements needed you have made yourself. Here is how to figure out the moon's diameter

(The distance of tapes from eye) in to (the distance between tapes) as 239,000 is to (the moon's diameter)

It will be well to make your observation and measurements three times, taking the average of the three distances from the tapes to the eve

Here are the results from the experiment as I tried it. Average distance of tapes to eve. 137.5 mehes. Thitance between tapes. 1 15 aprilers

1.4. to non jus "to 20.6 "Se 47 4 2 1 + males

The moon's diameter, measured in this cande way, comes out only one (wo-huodredth larger than astronomers make it by the most refined methods

While we are making measurements of the moon, it will be interesting to see how the height of its mountains were measured I believe you will agree that the method is extremely ingenious

AN ORANGE beld in the light of a lamp experiment. A kmall wad of chewing gum will serve for a mountain

Turn the nrange toward the lamp until the light from the lamp just grazes the topof the mountain peak. When the astronomer observes this condition, he measures through his telescope the distance from the line between the moon's lieut and dark parts (the "terminator") to the tip of the mountain which is existing the light. This measure ment as done with a telescope attachment called a nucrometer

Since the radius of the moon is known accurately and the micrometer has measured the distance from peak to terminator, the astronomer now has two sides of a rightangled triangle. The third, unknown side, is the radius of the moon, plus the height of the mountain. One of the samplest rules in geometry enables him to obtain it. He then subtracts from it the radius of the moon. and has the height of the toourtain wif-Heights of many of the moon's mountains have been found by this method



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will you be doing one year from today?

Testal hundred and sixty-five days from now-what?

Will you still be struggling along in the same old job at the same old salary warried about the future-never quite able to make both ends meet?

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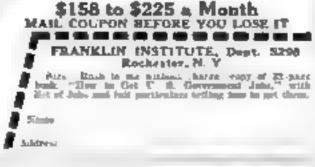
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Look at Page 31 and read about these nteresting new handbooks.

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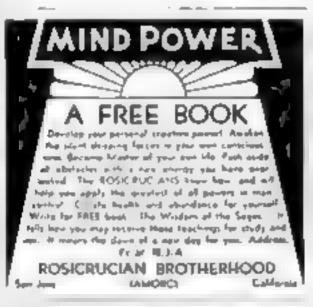
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NEW FEDERAL SERVICE TO END DESTRUCTION OF AMERICAN FARMS

(Continued from page 39)

slopes as steep as twenty-eight per cent. In the Piedmont country of the South, that method of cultivation will be recommended for slopes up to ten per cent. In the extensive red hill country that extends from near New York City south into Georgia, terracing will be used on slopes up to seven per cent. and strip cropping on alopea between seven and ten per cent. On slopes between ten and eighteen per cent the seeding down of the land with thick-growing grasses will be recommended, and on slopes steeper than eighteen per cent the experts will try to induce the farmers to plant trees to hold the soil in place.

MANY farmers, unfamiliar with strip cropping, are likely to object to the method because it reduces the proportion of the land planted with money crops. Soil Erosion Service experts expect to overcome their objections by showing them what strip cropping dues for the (armer

Used under right conditions of slope and soil, it stops soil washing. It also encourages the rotation of crops that keeps the land from becoming impoverished by the drain of growing the same crop year after year

Strip cropping such as now is being used on the prosperous Easton farm, near La-Crosse, Wase, will be used to consince the doubting farmer of the value of the system. Although the average slope of the fields of this form is twenty per cent, the corn grown in them is of excellent quality, and there is almost no loss of soil. A six-year rotation of crops is used. Planting is in strips about 100 feet wide. This year the strips, from the top to the bottom of the slopes, were minda harley, alfaifa com, alfaifa, and corn, Next your the top strip will be corn, the second alta-fa, and so on down to the bettom of the sorpe. The thick growing, toughrouted alfalta keeps the soil from washing during even the beaviest runns, and entiches the land for the following year's corn trop-

Rumed and abandoned farms are trage object lemons of the cycle of sall croston. But even more serious is the damage that is being done to some of the rithest crop lanua

in America.

There is, for example, the famous cottongrowing Black Belt of central Texas, Slopes ure gentle, averaging no more than five perrent. Yet at every heavy rain, the rich back soil melts away like so much sugar. There are no unsightly gullies, no early seen signs of the tremendous damage that in being done For here sheet erosion, the slow but implacable variety that takes a firm of soil off no entire field, is getting to its deadly work.

TRIP cropping experiments in the Black Belt have been high y successful, and it is probable that the method wal be adopted generally throughout this region.

Another exceptionally rich farming fegion that is being damaged by erosion is the Paluse wheat belt of Washington, considezed the finest wheat land in America.

In the early spring, when the mow on the crests of the bills has melted, but remains on the lower slopes, erosion can be seen at its work. You can see many tons of rich son from the upper fields being washed over the snow on the bill sides, and so carried into the streams.

In the district the use of the Davis cultivator has been successful in controlling etnsion on slopes up to twenty per cent. This machine, the invention of R. H. Davis, a soil expert of the Department of Agriculture, combines with an ordinary cultivator a set of shovels that dig (Continued on page 99)

NEW FEDERAL SERVICE TO END DESTRUCTION OF AMERICAN FARMS

(Continued on page 96,

10,000 shallow holes an acre. Its use gives a wafflelike appearance to the fields. Soow and rain are retained in the many shallow holes, so that the moisture sinks into the land instead of running down the slope and wash ing the soil away. This cultivator has been used auccessfully in the wheat fields of western Kansas, and now is being tested in other regions with corn and cotton crops.

Terracing is another crosson-control method that will be demonstrated and taught by Soil and Erosion Service. It is an old method, having been used in Europe and the East since long before the beginning of the Christian era. It also has been used for muny certuries in the Ander Mountains of South America. It is doubtful if our farmers ever will have to go to the extremes of the Indians of Bulivia, who plaster slabs of loose shale down on a preep mountainside, and then grow their crop in the shallow troughs between the slabs

THE cutting down of our forests and the L custivation of our land has speeded up the processes of crosson.

Refore the native practic grass was ploughed under in the Red Plains region of Kansas, Okiahoma, and Texas, the fine wheat-growing soil stayed put, But last sommer, after a lung drought, the loose, dry soil brigan I wing out of the ploughed fields of western Kansar, and continued blowing out of them for three solid months. Enough of the Red Plains was blown several hundred miles into Iowa and Nebruska to give a red and to the native black soil of those states The farmers of lows and Nebraska didn't object, for the red soil is rich stuff. But the wind crosson cost the wheat growers of the Reg. Plants to Highs of do sars in damage.

In the old days, when the farmer followed on the heels of the frontiersman, and the frontice moved over westward, the destruction of land by sail washing or unwise farming from t seem to matter. There always was good land farther west. But now most of our land that is justable for cultivation is in use either for growing crops or for pasture So we must save all the good soil we have left. That's the highly important job of the new Soil Erosion Service

LOGS BRING FRUIT FLIES

Loca shapped into this country from the south of France are believed to have been responsible for an outbreak of the Dutch elm assesse which has attacked trees in the easiern part of the United States. The affected elms are along the line of the rudrouds over which the loss were transported in New Jersey, New York, and Connecticut, Six hundred and three chas have been in fected and the agricultural authorities are taking immediate steps to prevent the spread of the disease. Recently, when the new U. S. Navy dirigible, the Macon, flew west to its permanent hangar at Sunnyvole, Calif., from Lakehurst, N. J., two Department of Agriculture men impected it carefully to see that it had transported no fruit flies

GROWING BRAIN CAUSE OF MIGRAINE HEADACHE

Ir you wase up in the morning with a splitting headache, it may mean that your brain is growing! At least, that is one conclusion which may be drawn from a recent report made to the American Medical Association. After special research on migraine headaches, Dr Peter Bassoe, of Chicago, has advanced the theory that such pains are due to the brain growing faster than the skull.



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OUR idea for a practical article Y or an improvement upon an old one should be patented NOW. Frequently many of the thousands of applications filed in the U.S. Patent Office each year are for the same or almost the same idea. In such a case, the burden of proof rests with the last application filed. Sometimes a delay of even a few days in filing the application means the total loss of the patent. Lose NO TIME.

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QUEER THINGS HAPPEN TO PEOPLE IN AUTOMOBILES

(Continued from page 37)

through the rear window of the machine, the car swerved to the cush and two menleaped from the front seat and ran. In the rear, the policeman found three other men. One was rigid in death, shot through the heart. The other two were wriging, straggling, trying to get away, gripped in the death-locked arms of their companion.

Automobile accidents range from the absurd to the trace, from the results of odd quirks of psychology to the products of spectocular, engovernable twists of fate.

Traffic officers have to be prepared for the unexpected. Even so, they frequently get joits of surprise.

FOR example, when a motorcycle cop in Springfield, N. J., overtook an automobile that was signatured along the road, he found the driver, his bands off the wheel, peering intently into a compass held in his lap. In Chicago, after a long chase, the police over took a car in which it had been reported. "two men were kildinging a girl," They found two unnocent clerks transporting a dequatment store dummy.

Sometimes the unexpected twist at the end of the chase is trace instead of ludicrous. Thus, in Scarsdale, N. Y., when a motorcycle patrolman was overtaking a speeder he saw the machine come to a sudden stop and heard the crack of a pistol. Slumped in the seat of the car he found a business man who, oppressed by financial worries, had been so completely depressed by the prospect of an arrest for speeding that he brought his car to a stop and committed suicide.

Tests have shown that when a front tire blows out at forty-five miles an hour, it is impossible for a driver with one hand on the wheel to keep the machine under control. A Chicagoan, taking his best girl for a drive, proved the tests were right. His car swerved climbed the curb and knocked the front porch off a house belonging to a policeman Then the for begun!

Three other curious reports have recently come from Chicago. Peter Pennacchia was driving along a highway when Miss Pauline Stanak smashed into him, lacked away and drove hastily off. Leaving his wrecked machine by the roadside, he returned home, got his other cur from the garage and started for the scene of the accident. As he turned the corner, he was smashed into again by Miss Stassak.

AT NOON TIME, an Danois shoe salesman went into a Chicago restaurant leaving his car outside. When he came out, he found a thief had carefully cut a hole in the roof of the car and stolen 350 sample above all fitting the left foot

But possibly the queerest expenence of any Chicago motorist occurred when a radio performer west to a downtown station to broad tast. Arriving fate, he was unable to find a parking place until he discovered a vacast lot down a side street. The deserted apor proved to be part of a junk varil and when the broadcast was over, the sincer found four men taking his car apart. They thought the machine had been towed in for dismanting?

In Loe Angeles, Calif., a surprise almost as long greeted a driver when he came out of a past office where he had none to buy a stamp Has show new section looked like a plug hat upon which a fat man has sat A his elm tree, operated by the wind had fallen and landed at age, who top of his car.

It was nother same western city that what is probably the most curious plea ever entered in court was made as the result of a traffic violation. Lucio Godina, a Stamese twin,

had been trrested for driving his car through a red light. When the case came up, the judge suspended sentence because the innocent Siamose twin Simplicio, who was joined to his brother, pleaded that it was untur to fine him or send him to jail for Lucio's offense!

QUEER, out-of-the-ordinary happenings have recently taken place at radiway crossings, blore one-half of one percent of the accidents and four percent of the deaths in automobiles take place.

In California, bear San Jose, a limited struck the stalled car of M. T. Moran, a six-ty-two-year-old stage acrobat. Just us the true hit, Moran did a backward somersaul, and saved his like

On a crossing near Wahpeton, N. D., Nels Berein was frantically trying to crank his balky our when the train crashed into it. The automobile was smashed to bits, leaving Ber-

via, untouched, whirling the crank in his hand. A cautious driver in New Jersey carefully slowed down and came to a stop at the low-cred gates just at a fast train rounded a curve. Coming up from the reat, a speeding rar, with faulty brakes, struck the back burnier of the stationary machine and pushed it through the wooden barrier onto the track in front of the express. The driver was instantly killed.

Near Gansevoort, N. Y., a driver was croming a wooden bridge at a low rate of speed when it caved in and he was seriously fart. Itut, at Missouri Valley, Ia., when two speeding motorists (saled to see a "Bridge Out" sun, there are hurrled across seventy feet of water and landed them usin, and in the soft mud of the opposite bank!

THREE negro ball players in Alabama I were killed when a truck upon which the team was reling backed up and they fell out into a well. In Brooksyn, N. Y., a car, running wild at high speed, trushed through a brick wall with set doing more than shaking up the driver!

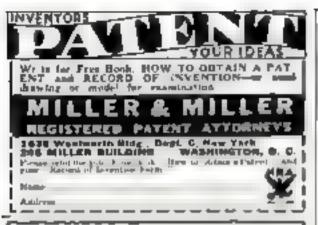
In California, a motorist was moving along a highway at twenty in ice an hour when he was injured by a fountain pen expluding in his vest picket after he had placed his pipe beside it. In New York City, a taxt skidded through the railing of a bridge, turned a complete somer-sult in the air, and landed right side up on the ground forty feet below without hurting either the driver or the passenger and without even hursting a tire!

Not long ago, (Sept. '33, p. 32) Popular Science Montrey told how laboratory tests and torture-chamber shocks are employed in rubber factories to determine the endurance of modern tires. None of the tire-wrocking apparatus of the laboratory produces punishment comparable to such a drop. Often from accidents and crashes, the automotive expertalizate facts and act ideas that help them develop stronger, saler cars

Voted the oddest accident of last year by insurance companies was a crash with a curious subsequent train of events that occurred when a Lynn, Man, florist dored off for a moment while driving his truck at night. The machine swerved from the street, crashed into a hydrant which sent up a geyser of water, struck a pole carrying high tension wates, which fell setting fire to the aut and ourning the florist. An electric drawbridge, operated by current coming over the wires, was crippled and truffic was paralyzed. In addition, all street lights up the district went out. For an hour or more, the section was alive with firemen, doctors, electricians, and water department men-restoring the city to normal conditions. (Continued on bute 101.

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OUEER THINGS HAPPEN TO PEOPLE IN AUTOS

(Continued from page 200)

A close second was the trail of wreckage left by a specifing taxi driver coming down the Brooklyn Bridge ramp in New York. When his brakes failed to hold, the machine bounced off a street car, mounted three curbs, sent pedestrians scurrying, dragged a street traffic cable and stanchious. trashed through a news stand, cracked a subway koosk and stopped at the bead of the subway steps within an inch of plunging down them

A NOTHER wholesale crash resulting from faulty brakes took place, not long ago, in Englewood, N. J. A truck rounded a turn too fast and struck a line of passenger cars parked side by side. It wrecked seven machines, jamming them together like a compressed according

According to statistics compiled by the accident insurance companies, one out of twenty drivers, last year, was in a motor muhap of some kind. Fortunately, many of the acridents were not serious. Not infrequently, by some curious quirk of fate, the seemingly unimportant mustap turned suddenly important and resulted in serious damage or injury

For example, a car coming from a side street in a western city just missed crashing broadside into another machine speeding down an avenue. It struck it a glanting blow at the rear But that blow tore loose the gasoline tank and the car went up in dames.

Sometimes, events which follow an accident are as invsterious and bewildering as the causes that produce it

In Rochester, N. Y., an auto knocked down Jose W. Kelly, sormed Memoan Labor Attache. When he got up he had lost his notity to speak boglish which he had could whee a vising man. He could converse in Spanish, but an injury to the cells of his brain in which the English words were stored had completely hiotted out his knowledge of the language

Similarly, as the result of an automobile accident in New York, Pauline Goodman lost her sense of taste. A jury awarded her \$22,500 damages when it was proved she was a cook who depended upon her sense of taste for her livebhood

When two cars crashed in Fort Worth, Texas, shattered gians cut the tip from the noce of one of the women passengers. After she had been rashed unronstrous to the hospital, a spectator at the scene of the accidest found the tip and taced with it to the operating room where a surgeon grafted it in place so that she feft the hospital only slightly scarred by the accident

POLR o'clock in the morning according to driving The fewest accidents occur then. Yet at this very hour one of the most curious crashes took place. In Mixidletown, N Y two cars collided head on the driver was cataputted through his windshield, over the boods of both cars, through the windshield of the other machine, and into the lap of the other driver

As a final adiation to this collection of accident oddities consider the expenence of a Waynesburg, Pa., motorist. On a cold moraing. Thomas Parkinson, son of a Pennsylvama state senator, went to the garage to get out his is her car While warming up the engive he was overcome by carbon-monoxide tumes. As he fainted, his head tell forward striking the button at the center of the wheel. The continued sounding of the horn attracted the attention of peighbors and he was rushed to the hospital in time to save his life!



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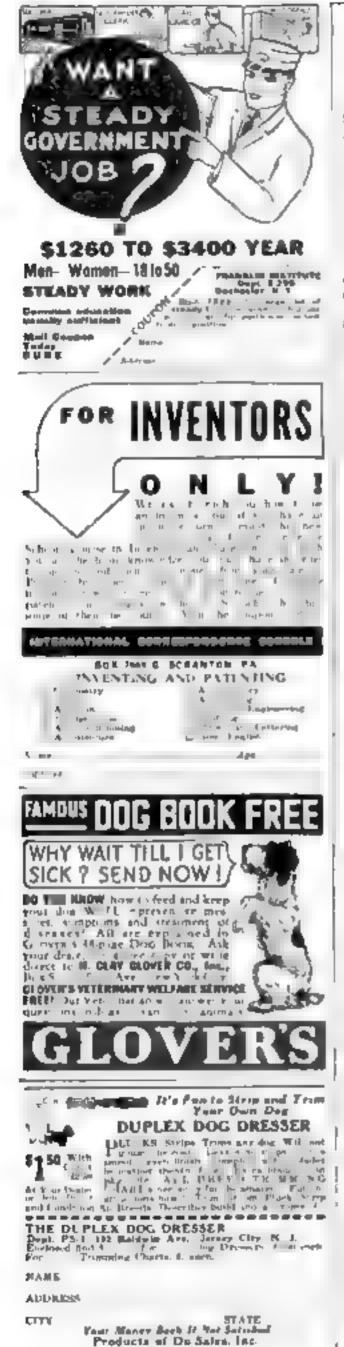
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NEW METHODS FOR CARE OF DOGS UPSET THE OLD IDEAS

(Continued from page 33

from a moving automobile and to grawl and anap at possersby, don't be surpresed if a year later some stranger complains to the police about his vicious randuct. In ninetynine cases, had dispositions in maturity may be charged directly to the owner

IN MOST cases intensive training is wholly unnecessary unless for some highes special-wed wink. Half an hour each day e-unvaried routine and the same verbal commands and the same reward when a thing is done correctly will provide healthy, out-of-door exercise and soon make the dog into a delightful companion. Speak the commands in a trisp, cheerful voice and the dog instinctively will put that snap and willingness in his effort that gives the master pleasure.

For the average due owner, it will be sufficient if the dog will do any reasonable thing it is told and do it instantly and instructively Good manners and habits are executal. The dog also should leave untouched any food hying on the ground or offered by strangers. He can be easily taught to eat only his own food, and then only on command, to stay in an indicated place and to guard objects, search for them by seent, and to walk at beel without a lead. The latter tayes many hearthreaks, especially where traffic is thick,

In training a young dog to have good cleanly habits in the house, bear in mind that he will prefer to go outside as far away from his sleeping place as possible. He naturally will seek something absorbent. It he cannot go outside, the same instruct well miscusde him to a rug. At the beginning, place him in a room where there are no rugs and with a newspaper on the floor. There will be no trouble

Certain breeds are more amenable to amaleur training than others. Shepherds, usually called police does, are more highly strung and more temperamental and consequently more receptive than the overage. When it comes to actual tricks, the terrier breeds are very responsive. The backbone of most caudeville acts used to be the old-(ashionest French poodle. Chows are more treatures of habit than any other breed, and they acklom can be looled more than once in the same way. They remember well what they are laught, though they are slow to learn

CHASING automobiles, a primitive hunting instruct gone wrong, is a habit that eventually ends in death. However, it can be cuted in a young dog. The hun near the road or street by a long rope. Let him run, only to be severely thrown as he comes to the end of his tether. This may bruise hun, but it will stop the babit and save him worse pain. Better yet, hold the line yourself and call him back when he starts toward the retreating car If he abeys, okey; if not, jerk the rope as he nears the end of his run. It is a bad habit, and must be stopped. Whipping does not seem to help even when applied at the moment.

In taking cure of these pets, remember it is no more dancerous to buthe a puppy under six months old than to wash a haby. It it is bathed in warm water and dried quickly in the warm sun or is a warm room, and then not subjected to draft or cold for a half-hour after it appears to be dry, you can wash it every two or three days without danger

Careless drving may produce a cold or pneumonia, but it will not cause distemper Detemper comes from infection or contagion. Some breeds are more subject to colds than others. Wolfhound, police dog, setter grey-hound and whappet puppies require a little more consideration in washing than most others.

Does cannot tell us how they reel an

health or in sickness. Diagnosis is largely guesswork based on former experience. Simple remedies and simple treatment are always safest, for we can in this manner be sure we are not aggravating their trouble.

It usually is the actual nursing that cures the dog. In almost any sickness, no matter how sensus, keep him in an even temperature in his home or kennel, away from the sand drafts, and give him light, easily digested food. If he realizes he is being cared for by his own people, nature usualty will adjust the frouble and bring him back to good heal h

ACONCRETE kennel in the lee of the house serves well for all seasons, in sickness and in health. This type of house is warm in winter and cool in summer since it does not conduct heat and cold easily. A canvas drop will stop the draft, yet permit the dog to enter and leave easily. A hole in the front near the roof permits enough ventilation. A suck covering a raised wooden floor will help provide warmth.

inside the house, a three-saled box with a mattress field with cedar shavings will provide comfort and shall out drafts

Frequently a dog suffering a broken lea will become accustomed to using the other three and will develop a three-leaged gut The cure is simple. When the leg is completely bealed, get a piece of light wood about the usual thickness of the side of a small grocery box and cut in the shape of a hoomerang. Whittle it down smooth, then wrap it with adhesive tape to soften it. Take the opposite leg and bend it so the foot is about one and one-half inches from the ground and cut the wood the same angle as the brid in the leg when in that position. Whip the leg in place against the board with adhesive tape, not too tight to restrict circulation. By alternating, three days on and three days off he soon will be using the atrophied led normally. This is sumple, painlest, and effective.

Some of my friends complain that when their does pull against the collar thes choke and gag. They fear gotters will result had dog ever pulls hard chough against the collar to injure himself, nor have I ever known any line to have a noiser. You can break a pup's pulling habit when lead-breaking him by pulling him up sharply a few times. Most of the trouble is caused by using harness, which, because of its comfort resuly teaches him to pull. In fact, few breeds look well in harness and a collar will cause no harm Even a slip collar that tightens when the dog pulls too hard will loosen when he releases the oresiste.

A don requires little room when traveling Smaller breeds may be transported in a ligh carrying case with an open streen to provide

If IT becomes necessary to muzzle a dog, a simple device from a single length of four-inch surgica, gause will be less bothersome to him than leather affairs, since it cannot cause any pain. This can be made by folding the cause in the center, tying a loop in the center, passing the free ends under the mouth, where a sincle loop should be tied, passing these ends back of the enes and over the neck, where a second loop should be tied. Then run one of the free ends through the loop on top of the head and make tight. The animal soon will become accustomed to this muzzle.

The spring is the best season for stripping, in order to make the dog comfortable through the heat of summer. When a rough haired dog's coat grows old and becomes loose, no matter when the season, the dead hair gives him a little warmth. (Continued on page 103)

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NEW METHODS FOR CARE OF DOGS

(Continued from page 102)

He has a thick undercoat below that which provides all the warmth and protection he requires.

If he has reasonably warm quarters, you may strip him even in midwinter. Hold small clumps of hair between the serrated edge of a stripping knife and your thumband pull sharply in the direction the bair is growing. If he were living a semi-wild life he would pull out the outer hair as he runs through brush and brambles, but those living domestically will shed considerably in the bouse and scratch, which is the only way be knows to rid himself of the old coat,

"LIPPING, akhough quicker and cheaper... Should not be done, because the clippers cut the old cout instead of pulling it out by the roots. They also cut the undercoat, leaving the animal without adequate protection. When the coat grows out after clipping It, it will not grow naturally. Stripping is a natural and painless process, while clipping is not.

When grooming, remember that roughhaired dogs require slightly different treatment from smooth-haired dogs. At any pet shop, you can purchase a fiber hound glove, one side of which is set with fairly soft bristles, the other with slanting wire bristles. The latter, with the aid of a comb, will smooth a coat of roughest hair. Nails should not be permitted to grow long, or you will pay the penalty in torn rugs, curtains, and silk stock-

In their old age, does suffer misery with their teeth, especially those that continually chase stones and sitcks. When one reaches the ripe old age of nine or ten, his teeth are likely to be worn to the gums. Very few people ever think of having those old stumps extracted, yet to do so is not only kind and humane, but also will asld several years to his life. At the same time, give him food that in neither hot nor cold. Pomeranians especially suffer from their teeth. Even with this handicap, they live longer than any breed I know, and their life span could be easily doubled by proper dental care,

CLOUDS OVER EUROPE STUDIED ON ONE DAY

An international Cloud Day was recently observed in Europe. Scientists in the various countries took pictures of the clouds at three specified times during the day, and attached to them the weather conditions at the time, This composite record of the cloud and weather over Europe is now being studied in an effort to learn more about forecasting through the observation of clouds and upper air currents. It is the first effort made to obtain a widespread pictoral record of cloud conditions at a given time.

AMERICAN WOMEN'S FEET ARE GROWING LARGER

THE feet of American women are larger today than they were ten years ago. That is the conclusion of the National Shoe Retailers' Association. The records of this organization show that in the majority of cases the selection made by American women today is size five. Ten years ago, it was size four. Earlier, it was size three. A better understanding of the pervous strain that results from wearing shoes that are too tight, as well as an actual increase in the size of feminine feet in the United States, is given as the reason for the present popularity of larger sizes.



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"How Do I Know It's Christmas?"

(By A Man Who's Been Through It Many Times)

VEN without holly and tinsel, trees and ornaments, I'd know it. One day—every year without fail—I walk into a room where there are a lot of packages marked for me. After they are opened, I find myself richer to the tune of one dozen neckties and two dozen pairs of socks, 'This must be Christmas', I say—and so it is.

"Now, I know that every Christmas present comes from the heart, but I'm practical and I wish they'd put a little more 'head' in with the heart. Neckties come in such astounding colors that I'd rather pick my own. And you can't do much with Christmas socks that are a size too large or a bit too small.

"Just let me put in a word for myself—and for a couple of million other men like me. We like Christmas presents, and we like to give them. But when we're on the receiving end of the exchange, it does our hearts good to get a really sensible gift—of practical and permanent value. Something that gives us enjoyment, something that reminds us of the giver—makes us think of him gratefully—six months—twelve months after Christmas has come and gone."

That's a frank, man's point of view, Isn't it yours? Aren't there men you know who you're dead certain feel that way? Wouldn't such a man say you used both heart and head when you sent him Popular Science Monthly for a year, as a Christmas Gift?

You know—without our telling you—what a delight Popular Science Monthly, with its fascinating news and amazing photographs of scientific progress all over the world—can be to the man who wants and values a practical gift. When you make this gift—be he father, son, brother or friend—a year's subscription to this graphic nugazine, every new issue brings him another reminder of Christmas—and another grateful thought for the friend who made so wise a selection.

While we're on the subject of gifts, we'd like to give a little Christmas present ourselves. The regular subscription price of Popular Science Monthly is \$1.50 a year-but, to every reader who wishes to send the magazine as a gift, we'll give our own Christmas present of twenty-five cents, so that, for each friend to whom you send Popular Science Monthly on this special occasion, you need send only \$1.25 instead of \$1.50. Here, however, is a gift you cannot measure by cost, because it is so very inexpensive-and yet its worth in terms of interest and genuine pleasure for the gift receiver is invaluable. And, to carry out the spirit of the season still further, we shall mail to every friend to whom you send Popular Science Monthly as a Christmas Gift, an appropriate Christmas Card, bearing your own name and your good wishes, and telling him Popular Science is coming as your gift.

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